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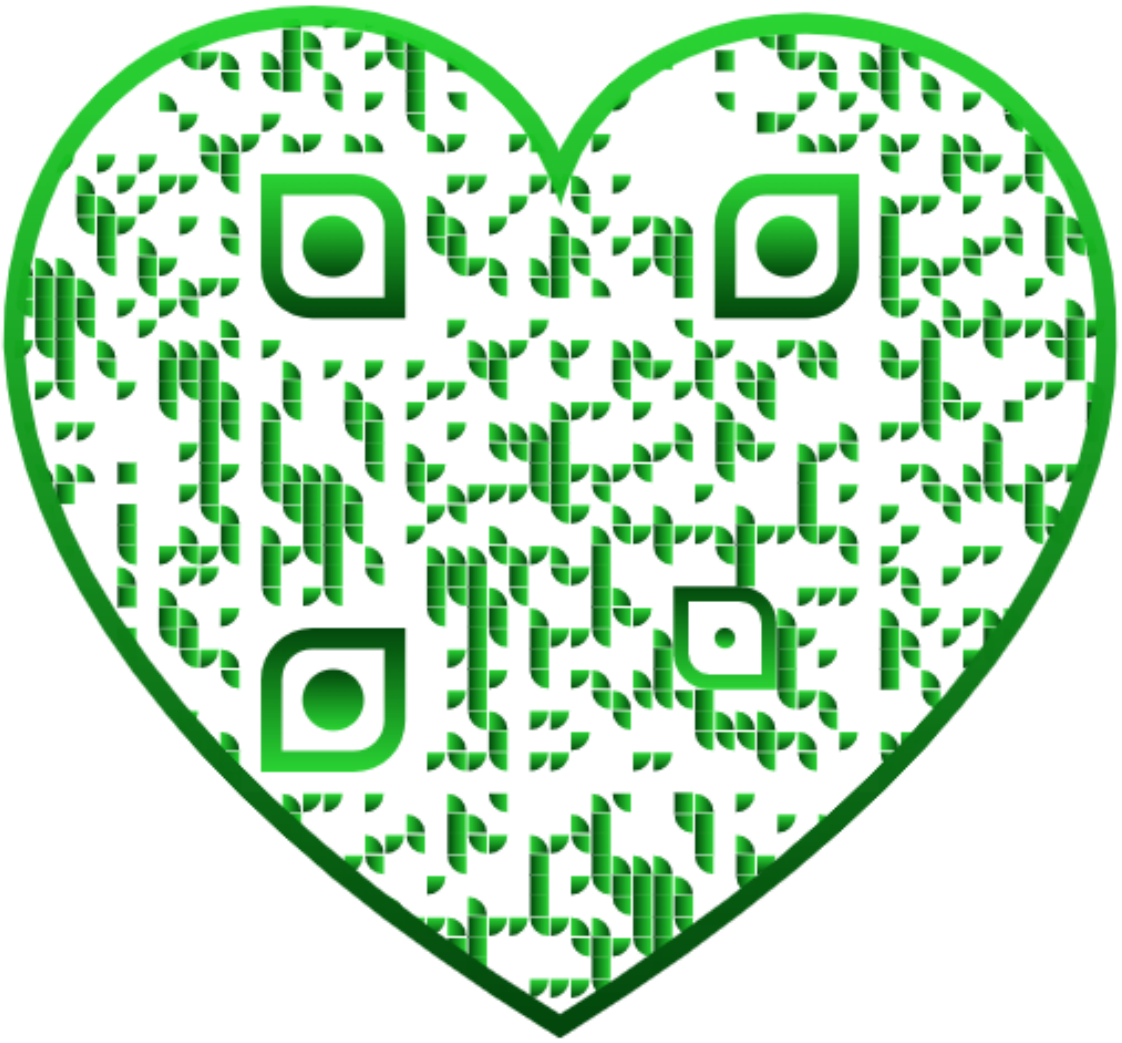

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AEROSPACE

Volume 52 Number 9
September 2025

EDITORIAL

Muzzling the military

This month the global defence industry descends on London's Docklands for the biennial DSEI exhibition – a showcase of military technology and equipment. With Europe rearming at speed, the world grappling with new uncertain geopolitical realities and, for the UK, a recent *Strategic Defence Review*, this is set to be one of the most important DSEIs in recent years.

Yet the UK MoD, and its senior officers, who will be front and centre at this event – and there to help promote UK PLC's aerospace and defence industry – are now hampered by Orwellian new media rules seemingly emanating from the Cabinet Office and No10. As such, they cannot speak to the press unless it is via carefully vetted pre-approved public scripts. This has already affected defence conferences and events where UK top brass were present, such as the RAF's Global Air and Space Chiefs' Conference (see p34) – stifling debate and healthy discussion. At GASCC, for example, there was the bizarre scene where any RAF and UK senior officers on panels were described as 'not for reporting,' while their international peers were allowed to speak freely – a policy that effectively muzzled the RAF at its own conference.

This disturbing trend of restricting media access to senior officers is not limited to the UK either. In the US, long enjoying the protection of the First Amendment, the current administration is now clamping down on the press – with new restrictions, including journalists being banned from certain areas of the Pentagon without an escort. Additionally, a new policy has seen the US military withdraw support from officials attending think tank events, conferences and forums – with approval now done on a case-by-case basis.

These changes in transparency and accountability come at a time when the public is increasingly worried about the threat of war, emerging technologies and the national defence readiness to meet these challenges. For a functioning democracy, restricting the reporting of military officials at this critical time – when there is broad support for increased defence spending but the public want to be informed about the actual risks – is likely to be self-defeating when governments may need one day to explain why young people are being sent off to die.

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Front cover: Still fabulous at fifty? (Richard Freail)

AEROSPACE INSIGHT

Additional content is available to view online at: aerosociety.com/aerospaceinsight
Including: The Quick and the Dead 2.0: Can a demonstrator speed up Britain's next fighter? Mach to the future, SCAF - Dead on arrival? Finding the right blend, Betting it all on red and A bag for life?

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Militarised murmurations Can we take inspiration from nature to create a murmuration of AI-enabled swarming drones?

Air power faces 'Next Storm Rising' Global air and space chiefs descended on London in July for GASCC 2025.

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TABBIES 2024 Award Winner

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Blueprint

Spirit SE-1

Wingspan	24ft 7in
Length	18ft
Height	6ft 8in
Gross Weight	336kg
Empty Weight	200kg
Powerplant	42hp Spirit V2
Max Speed	97kt
Cruise Speed	87kt
VNE	122kt
Stall Speed	39kt
Climb Rate	750ft /min
Ceiling	17,500ft
Take-off Roll	152m
Landing Roll	244m

Snug cockpit

The single-seat cockpit is 25in wide and the adjustable seat and rudder pedals provide up to 37in in height from seat pan to rollbar and between 37in and 41in of legroom. The seat is fitted with four-point safety restraint. The maximum pilot weight is 125kg (19st 9lb) and a 3ft³ compartment can hold up to 9kg of luggage. The aerodynamic design of the open cockpit is claimed to minimise the effect of moderately cold weather flying.

Proprietary powerplant

Not content with designing an all-new aircraft in complete secrecy, Spirit Engineering has also created its own powerplant in-house. The 1288cc Spirit V2 is a normally-aspirated, two-cylinder inverted 'v', four-stroke engine. Air-cooled with a direct-drive, it produces 42hp and weighs just 45kg. The company recommends running the engine on 91 octane unleaded, ethanol-free, automotive gasoline (mogas) but aviation grade 100LL gasoline (avgas) is also approved.

Affordable flying

The ready-to-fly factory built SE-1 has a basic 'fly away' price of $69,500 (just over £50,000). The V2 engine burns just 7.5 litres of mogas per hour.

Spirit Engineering

Spirit Engineering

Secret factory

Colorado-based Spirit Engineering also released photographs of its impressive manufacturing base in Grand Junction with more than 20 SE-1s approaching completion. When asked in a media brief whether the images were AI-generated, officials phoned the factory and asked for photographs from different angles to prove their legitimacy. The company says it will begin deliveries this autumn and with orders typically ready to ship within three to six weeks after purchase.

Folding wings

The wings can be manually folded outboard of the undercarriage, reducing the aircraft's size to just 7ft 5in wide and 13ft 11in long. This is hoped to reduce hangarage costs and even means the aircraft can be stored in a standard car garage and transported in an enclosed trailer.

GENERAL AVIATION

Secret retro design breaks cover

US-based Spirit Engineering amazed the aviation world at July's EAA AirVenture event in Oshkosh, Wisconsin by debuting a hitherto unknown aircraft. Not content with bringing one aircraft to the show, the team flew no fewer than four SE-1s to the event. Developed in utmost secrecy over the last ten years, the SE-1 has been created to combine vintage art deco looks with modern ease of operation. Constructed of corrosion-resistant Alclad aluminium, the aircraft is fitted with modern MGL Avionics instruments but owners have the option to register the aircraft as an Experimental Light Sport Aircraft (ELSA) and fit avionics of their choice. The aircraft even comes with dual USB charging ports. Although currently only available as an open cockpit taildragger, the company is already working on enclosed canopy and tricycle geared options. While stressed to 4G, aerobatics are currently prohibited.

Radome

DEFENCE

UK and Türkiye sign Eurofighter MoU

On 23 July, the UK and Türkiye signed a Memorandum of Understanding which moves the latter one step closer to purchasing the Eurofighter Typhoon. UK Defence Secretary, John Healey MP and his Turkish counterpart, Yasar Güler signed the MoU on the opening day of the IDEF expo in Istanbul. German opposition has so far delayed this proposed purchase but agreement from the German government paves the way for a contract for up to 40 Typhoons to be signed later this year. The deal could also include MBDA Meteor BVR missiles.

● Also at IDEF, Türkiye's TAI signed an agreement with GE Aerospace to explore collaboration, potentially fitting the F404 engine to the forthcoming Hürjet advanced jet trainer.

AEROSPACE

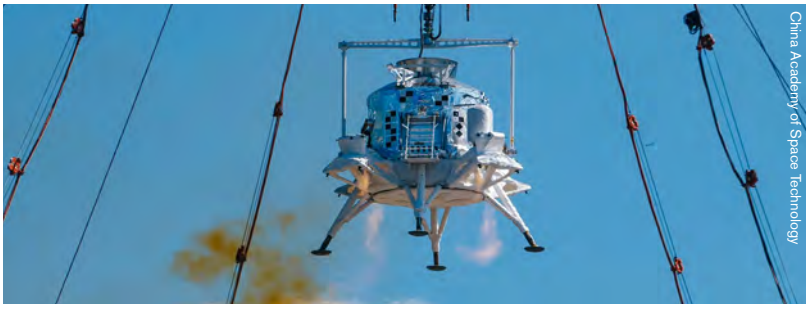
NASA trials crashworthy eVTOL tech

NASA has been undertaking further eVTOL safety trials – focused on crashworthiness. These involved dropping a test fuselage of a representive eVTOL from a gantry in order to show how energy-absorbing lightweight materials will be able to protect passengers in the event of a crash.

Read the 2024 RAeS paper *Shaping the Future of Advanced Air Mobility Safety* here.

SPACEFLIGHT

China tests human lunar lander



China's Lanyue lunar lander undertook its first ascent and landing tests on 6 August at the Extraterrestrial Landing Test Site in Huailai County, Hebei Province. The device consists of a crew and a propulsion module and is envisaged as a way to transport astronauts and supplies from lunar orbit to the surface of the Moon. According to Chinese authorities, it has the capacity to carry two astronauts, a lunar rover and scientific payloads.

AIR TRANSPORT

EASA backs away from single-pilot ops

EASA has suspended its research into the viability of single-pilot airliner operations (SPO) and extended minimum crew operations (eMCO) over safety doubts. Work done so far has found that the necessary technology to enable one pilot to oversee the cruise phase of a flight is not sufficiently mature at the moment. The report concluded: "An equivalent level of safety between eMCO and normal crew operations can currently not be demonstrated." For now, the focus will be on improving self-diagnostics and automation. Pilot unions campaigning against SPO welcomed the move with Capt Tanja Harter, ECA President, saying: "To us – European pilots – this very straightforward conclusion confirms our long-standing concerns."

NEWS IN BRIEF

Boeing employees working on F-15 and F-18 production have gone on strike in a dispute over pay and conditions. Some 3,000 workers, represented by the International Association of Machinists and Aerospace Workers at the company's St Louis, Missouri plant, refused a Boeing offer which would increase their pay and retain existing overtime rules. It comes after a seven-week strike last year disrupted Boeing civil aircraft production.

Swiss International Air Lines has taken delivery of 'solar fuel' which has been produced by technology company, Synhelion. Under this process, electricity captured from solar energy produces synthetic crude oil which can then be refined into jet fuel. The first batch was delivered to SWISS at Hamburg Airport.

Seventy years to the day since the prototype Lockheed U-2 performed its inadvertent maiden flight in the hands of Tony LeVier on 1 August 1955, a U-2S landed back at Beale AFB in California, having established a new endurance record. It landed 14 hours and more than 7,000 miles later, having overflown all 48 contiguous US states at 70,000ft. Although originally slated to be retired in 2026, the House Appropriations Committee announced in June that it had barred the USAF from retiring more than eight U-2 aircraft in FY26 and authorised $55m to fully restore three jets.

UK-based rocket manufacturer, Skyrora has gained a licence to launch its Skylark L vehicle from UK soil. Plans will build on lessons learned from the vehicle's unsuccessful launch from Iceland in 2022. This comes after the *Financial Times* reported that the company was looking to launch from outside of the UK due to the amount of time needed to obtain a licence. (See 'Space for growth', p16)

Swiss OEM, Pilatus is to temporarily pause deliveries of its PC-12 and PC-24 aircraft to the US due to the 39% tariff rate. The company stressed support to its existing US customers will not be interrupted

DEFENCE

Ukraine arms cropduster with AAMs

Via X

Ukraine has adapted an agricultural aircraft to carry air-to-air missiles in order to counter the threat of Russian drones. Pictures of the Czech-built Zlin Z-137 Agro Turbo (known in NATO as the 'Archer') carrying two IR R-73 missiles have appeared on social media. The R-73 has also been adapted to be carried by uncrewed boats, which have shoot down Russian helicopters, and shipping containers that are placed in key locations for distributed air defence.

GENERAL AVIATION

Piper lands biggest ever flying school order

Piper Aircraft has agreed a deal for up to 188 aircraft with the University of North Dakota's John D Odegard School of Aerospace Sciences. The initial contract, worth around $155m, covers 145 training aircraft with the option for another 43,, encompassing the Archer TX and Seminole models. Deliveries will start in 2027 and depending on options could run until 2036. The partnership in this deal dates back almost four decades and the new agreement builds on this for up to another decade into the future. UND's existing fleet is spread across a total of 176 aircraft and training devices. An earlier UND agreement in 2016 covered 112 aircraft and will conclude next year.

AEROSPACE

UK allocates extra funding to scale up SAF

The UK government is to provide £63m funding to 17 companies to fund the continued development of sustainable aviation fuel (SAF). This builds on £198m which has been allocated through the Advanced Fuels Fund and comes after the UK's SAF mandate entered force in earlier in January. Recipients include the University of Sheffield's Energy Innovation Centre, OXCCU Tech and LanzaJet. OXCCU now has a demonstration plant at Oxford Airport and claims it could be producing fuel by the end of this decade.

● Meanwhile, three SAF initiatives in India, Argentina and Indonesia have respectively seen a SAF refinery certificated, a $400m JV launched and the first batch of cooking oil derived SAF delivered.

AIR TRANSPORT

Lessor Avalon places 90-strong Airbus order

Airbus

Aircraft financing company, Avalon has placed a new order for Airbus aircraft, divided between 15 of the A330neo and 75 of the A321neo. As a result, the company's portfolio of each type will rise to 79 and 264 respectively. (See 'Rent don't buy: inside the economics of aircraft leasing' p 40).

and some Pilatus aircraft components that are produced in the US could be exempt from Trump's reciprocal tariffs.

A team at the University of Cincinnati is researching how the flight dynamics of an albatross seabird can be applied to UAVs. The aim of this is to demonstrate how a drone can adapt its flight profile to changing wing conditions, mimicking the albatross' ability to glide for up to 100 miles over the course of a week. The project has recently been the recipient of $700,00 in DARPA funding.

Cathay Pacific has ordered an additional 14 Boeing 777-9s. These aircraft will be split between examples with a denser seating across three classes and aircraft which have four classes, including a newly redesigned first class. The first of these new aircraft should arrive in 2027. Cathay's total 777-9 commitments are now 35 with options for seven additional airframes.

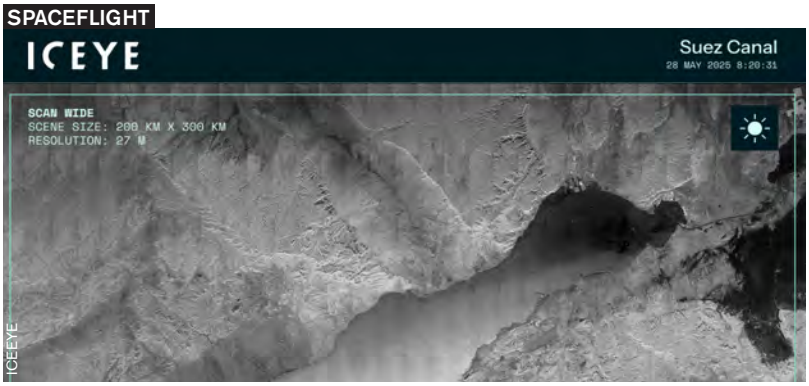
Spain is no longer considering the Lockheed Martin F-35 as its next fighter to replace its fleet of F/A-18 Hornets as tensions continue to be strained between the US government and its NATO allies. Switzerland too is reported to be mulling cancelling its acquisition of 36 F-35s after the US hit the country with a 39% trade tariff.

NASA has announced that it has used AI software in a satellite providing pictures of the Earth for the first time. Called Dynamic Targeting, this sees the satellite rapidly assess its orbital path and analyse imagery to determine the optimum place to point its camera. This process took place without any human input in less than 90 seconds. Dynamic Targeting can be applied to missions such as searching for weather systems.

The UK's National Police Air Service is to trial the use of UAVs for surveillance over England and Wales. The trial will use the Camcopter S-100 drone and cover defined areas in the South West, demonstrating how policing can use BVLOS UAVs.

Radome

SPACEFLIGHT



ICEYE gets wider field of view

Finnish synthetic aperture radar specialist, ICEYE has offered customers a new imaging mode for its satellites. Scan Wide will enable areas from 60,000 to 120,000km^2 to be surveyed, allowing for cueing of narrow search modes. The latter is valuable for applications, such as maritime surveillance with ICEYE then able to zoom in for further identification.

AIR TRANSPORT

ANA introduces AI-driven turbulence prediction

Following a period of testing, All Nippon Airways has begun using an AI-based turbulence prediction service developed by BlueWX. The prediction model, developed using deep learning techniques and a decade of turbulence data, has a reported 86% accuracy rate and operational trials involving 2,500 ANA pilots confirmed its reliability, leading to its formal integration into ANA's weather data infrastructure.

ANA and Keio University have been working on the prediction system since 2019 and co-founded BlueWX in July 2023. In-flight turbulence is reported to be on the increase, caused by climate change, although some sources also point to airspace closures channelling more flights through known storm regions, as well as economic and sustainability pressures to save fuel instead of going around bad weather.

DEFENCE

Poland to upgrade F-16s to latest V standard in $3.8bn deal

Poland has signed a contract to upgrade its F-16C/D Fighting Falcon fleet to the latest F-16V standard. The 48-strong fleet will be overhauled at the state-run Military Aviation Works No 2 with the upgrade including changes, such as the AN/APG-83 active scalable agile beam radar, as well as open-architecture mission systems and identification friend or foe capability. Overall, the upgrade will cost $3.8bn and will see the aircraft fitted with new weapons, including the AIM-9X Block II Sidewinder. Other NATO nations operating, or preparing to operate the Block 70/72 Viper include Slovakia, Bulgaria and Greece.

AEROSPACE

AutoFlight demos offshore eVTOL ops

China's AutoFlight has carried out the first shore-to-oil-rig flight of a 2t cargo eVTOL. The uncrewed V2000CG CarryAll delivered fresh fruit and emergency medical supplies from the coastal city of Shenzhen to the China National Offshore Oil Corporation's Huizhou 19-3 rig on 3 August. The autonomous flight across open water lasted 58 minutes and covered more than 90 miles each way. The CarryAll has a claimed range of 125 miles with a 400kg payload.

NEWS IN BRIEF

A fifth Boeing 777-9 twin aisle airliner has flown as the manufacturer moves closer to bringing the latest 777 variant into service. This will be followed by ground tests ahead of the first 777-9 being delivered next year.

International Air Transport Association figures for June indicated that growth in the global air cargo market had stalled amid renewed trade uncertainty, driven by US tariffs. Total demand was up just 0.8% year-on-year but demand in the US fell by 8.3% and Middle East demand fell by 3.2% in light of regional conflicts. In contrast, Asia-Pacific airlines recorded a robust 9.0% expansion.

German UAV manufacturer, Quantum-Systems has been supplying innovative drone systems to Ukraine. One is a catapult launched mothership called Sparta which can deploy an undisclosed number of UAVs or be modified for other roles. The second is the Vector which is AI-powered and uses acoustic sensors to 'hear' enemy artillery, drones and small arms, then pass data up the command chain.

On 1 August, SpaceX performed its 100th flight of the year, carrying 24 of Amazon's Project Kuiper satellites. This encompassed 97 Falcon 9 launches deploying satellites and three flights of the Starship Super Heavy. At this rate, the company is expected to surpass its 2024 total of 138 launches.

The Rhyxeon General Aircraft Company and Liaoning General Aviation Academy of Shenyang Aerospace University have successfully flown a hydrogen-hybrid electric four-seat light aircraft. The RX4M combines hydrogen fuel cells with batteries and is the latest development of the RX4 series, which already includes electric and hydrogen-powered variants.

The UK's Civil Aviation Authority has revealed the findings of 18 months of Department for Transport funded work into the safety of eVTOLs. The research has used cases, such as the British Grand Prix at Silverstone where eVTOLs are likely to be used in the future. 50 high-priority areas were identified, including the

AEROSPACE

Spirit AeroSystems takeover cleared by UK regulators

The UK's Competition and Markets Authority has approved Boeing's planned takeover of aerostructure giant, Spirit AeroSystems The regulator's investigation was triggered over concerns about the impact the proposal would have on competition. The regulator will now not instigate a more detailed 'Phase 2' investigation into the deal. Boeing agreed in 2024 to buy Spirit in a $4.7bn deal to insource production and address quality control issues. The deal will see Boeing acquire a portion of Spirit's Northern Ireland business, with other parts to be acquired by Airbus. As well as Belfast, Airbus is also set to take over Spirit factories supplying Airbus parts in Prestwick, Scotland, Casablanca, Morocco, Wichita, Kansas, Kinston, North Carolina, and Saint-Nazaire, France.

GENERAL AVIATION

'Here's to you, magniX Robinson...'

Robinson Helicopters

Robinson Helicopters will collaborate with magniX to produce an electric demonstrator version of the ubiquitous R66 single-engine helicopter. The aircraft will use the magniX HeliStorm engines and Samson batteries, with a maiden flight planned for 2026. MagniX flew a Robinson R44 retrofitted with electric motors during 2022 and, in March 2025, another R44 was flown using a hydrogen-electric powerplant.

AIR TRANSPORT

Dogfight over rival Heathrow plans

Heathrow Airport

Arora Group

Hotel tycoon, Surinder Arora has proposed an alternative to Heathrow Airport's expansion plan (right). The owner of the Arora Group has suggested a shorter runway which would not divert the M25 motorway and could be operational by 2035. His scheme claims it could cost less than £25bn and would include a new terminal which would open in two stages, in 2036 and 2040. The following day, Heathrow unveiled the costings for its own expansion plan (left) to be £49bn which, as well as the new runway, would involve closing Terminal 3, modernising Terminal 2 and three new 'satellite' terminals. Heathrow claims that Arora's 'Heathrow West' plan would not have sufficient capacity and that its changes to the M25 would improve the motorway.

DEFENCE

Joby targets military missions

EVTOL developer, Joby has become the latest OEM in the advanced air mobility sector to offer a hybrid version for defence applications and will work with defence contractor, L3Harris, which will 'missionise' the eVTOL for military roles. The new hybrid VTOL, to be based on the S4, will be able to operate in either piloted or autonomous roles, with flight testing to begin later this year and demonstrations expected in 2026. Modified eVTOLs with greater range than the all-electric versions could be particularly useful for logistics or ISR in austere locatons, such as the Indo-Pacific where they cost far less to operate than legacy platforms.

challenge of airspace integration and vertiport operation standards. The findings will now feed into the CAA's airspace modernisation strategy to prepare for eVTOLs in UK skies.

On 31 July, Jetstar Asia carried out its final flight, marking the end of 20 years in operation. The Airbus A321 flew from Manila to Singapore and comes after owner, Qantas decided to close the subsidiary in June.

A USMC MV-22 Osprey tiltrotor has conducted an anti-submarine warfare (ASW) sortie for the first time. During the flight, the aircraft deployed sonobuoys while working with MH-60 Romeo ASW helicopters flying from the aircraft carrier USS *George Washington*.

Airbus has completed the preliminary design review stage for ESA's TRUTHS Earth observation satellite. The role of this satellite will be to measure the radiation from the Sun onto the surface of the Earth, reusing a platform from the Copernicus CRISTAL mission and acting as the 'gold standard' reference for climate measurements.

UK-based operator 2Excel has become the largest operator in the world of the Diamond DA62 MPP aircraft. This milestone was reached after 2Excel received its fifth example. 2Excel uses these aircraft for missions, including maritime surveillance and environmental monitoring.

ICAO has released its *ICAO 2025 Safety Report State of Global Aviation Safety,* which found that there were 95 accidents involving scheduled commercial flights in 2004, up from 66 in 2023. The report noted ten areas of concern, including GPS jamming/ spoofing, turbulence, runway safety, timeliness of accident reports, intergration of advanced air mobility and UAVs and health promotion and mental wellbeing (See RAeS Mental Health in Aerospace Awareness Event 6 October, RAeS HQ, London).

Start-up Saudi airline, Riyadh Air will reportedly begin services to the Saudi capital from London Heathrow Airport on 26 October. The new service will most likely be intially carried out using British Airways' slots and a former Oman Air Boeing 787-9.

Radome

DEFENCE

UK MoD tests high-altitude spy balloon constellation

MoD

Under Project AETHER, the UK MoD has carried out trials of surveillance balloons with compnaies Voltitude, Landguard Systems and Aerostar. The balloons fly at 60-80,000ft for applications, such as ISR, communications relay and weather observation. These trials have taken place over the US state of South Dakota and have seen the balloons carry payloads of up to 3kg demonstrating persistent coverage of a target zone for nearly a month.

SPACEFLIGHT

Ariane 6 launches next-gen weather satellite

On 12 August, the Ariane 6 heavy rocket successfully made its third flight, launching the Metop-SGA1 advanced weather satellite probe into a polar orbit from the ESA spaceport, Kourou, French Guiana. This comes after the rocket's second flight in March this year when it launched a French spy satellite. The Metop-SGA1 weather and climate sat will be operated by EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites) and has a service life of seven and a half years. Built by Airbus Defence and Space, Metop-SGA1 is the first of six planned satellites in the Metop Second Generation constellation which will use polar orbits to deliver data for weather forecasting and environmental monitoring.

AEROSPACE

Lessors win landmark $4.5bn 'war risks' claim

At the UK High Court in London in June, five airliner lessors won a landmark legal victory against insurers over the $4.5bn worth of leased airliners stranded in Russia since the invasion of Ukraine. The group, which includes major industry players AerCap, DAE Capital, Merx Aviation Finance, Falcon 2019-1 Aircraft 3 Ltd, and Genesis Leasing, can now can seek to recover money for the lost 147 aircraft from insurers AIG Lloyd's, Chubb, and Swiss Re. In a historic decision, the High Court ruled that these aircraft were covered by war risks insurance policies after the Russian Government effectively banned its airlines returning the aircraft to their owners, after the lessors attempted to recover their aircraft in February and March 2022 following the invasion of Ukraine

AIR TRANSPORT

New-look Alaska sets sights on Europe

Alaska Airlines

Alaska Airlines will operate two new routes from the spring of next year. One will be a year-round service to London Heathrow and the second a summer season route to Keflavik International Airport in Iceland. Both will operate from Seattle-Tacoma. The London flights will use the Boeing 787-9 Dreamliner while those to Iceland will utilise the smaller Boeing 737 MAX 8. As Alaska expands its international network, the carrier has also revamped its livery to a blue and green scheme, evoking the Northern Lights and representing its core market of the Pacific Northwest.

NEWS IN BRIEF

France's Dassault Falcon 8X-based Archange SIGINT aircraft performed its maiden flight on 25 July. Launched in 2019, the Archange (Avion de Renseignement à CHArge utile de Nouvelle GEnération) programme is scheduled to deliver three airframes by 2030 to replace the C-160G Gabriel SIGINT aircraft.

A proposal has emerged for a 'rotating lightsail' to allow chipsats to cross interstellar distances after being flung from a lightsail sped up by the Sun. The Torqued Accelerator using Radiation from the Sun (TARS) concept would see a pair of 'paddles' with contrasting colour sides to accelerate the tiny probes to 558 miles per second or 0.3% of the speed of light.

As part of efforts to enable US to get ahead in the use of UAVs, the US Department of Transportation has proposed new BVLOS rules. Changes include streamlining the system so that operators no longer have to get permission to use a drone on a case-by-case basis.

Safran is to build a new carbon brake factory in Lyon, France. The site beat competition from rival options elsewhere in France as well as both the US and Malaysia.

ON THE MOVE

Nikhil Ravishankar has been appointed as the new CEO of Air New Zealand in succession to Greg Foran, effective from 20 October.

Air Vice-Marshal Suraya A Marshall is to be promoted to Air Marshal and to be Deputy Commander Cyber and Specialist Operations Command in December.

USAF Chief of Staff of the Air Force Gen David W Allvin has announced he will step down early in the coming months - halfway through a typical four year role.

Latvian carrier Air Baltic has named Erno Hildé former SFO of SAS as its new CEO, repalcing Martin Gauss who was dismissed in April. He officially takes over on 1 December.

GENERAL AVIATION

MOSAIC aims to revitalise recreational flying in US

Stephen Bridgewater FRAeS

Following a decade of research and discussion with General Aviation (GA) groups and pilots across the US, the Federal Aviation Administration (FAA) has revealed new rules that it hopes will revitalise 'flying for fun.'

Announced by US Transportation Secretary, Sean Duffy and FAA Deputy Administrator, Chris Rocheleau during July's EAA AirVenture event at Oshkosh, Wisconsin, the Modernization of Special Airworthiness Certification (MOSAIC) rules will take effect on 22 October, updating the Light Sport Aircraft (LSA) rules and Sport Pilot licencing that have been in place since 2004.

A weight off metaphorical shoulders

Crucially, the 1,320lb maximum take-off weight (MTOW) limit that applies to LSA aircraft and those exercising Sport Pilot privileges has been abolished. While this had previously allowed pilots to fly simple aircraft, the weight restriction meant it kept the useful load impractically low – with pilots often having to choose between baggage or fuel to legally remain below the limit.

In place of a weight limit, the primary limitation will now be a clean (ie with landing gear and flaps retracted) stall speed of 59 knots calibrated airspeed (KCAS) – itself an increase from LSA's 45 KCAS. Gliders and flexwing ultralights with no flaps retain the 45 KCAS max stall speed. All types will now have a maximum permitted air speed of 250 KCAS instead of the LSA's limit of 120 KCAS and Sport Pilots will also now be able to fly at night (following suitable training and approval) if they have an FAA third class medical.

MOSAIC also allows Sport Pilots to fly four-seat aeroplanes – albeit with a maximum of one passenger. This allows them to utilise the larger type's MTOW to carry more fuel or useful load, making them useful touring machines. Limiting the number of passengers reflects the desire to mitigate the risk of flying with a 'lesser' medical certification but increasing the MTOW also allows for the carriage of more avionics, safety features, such as ballistic recovery systems and allows for safety-design flexibility.

Sport Pilots are also now allowed to fly aircraft with variable-pitch propellers and retractable landing gear if they obtain the appropriate training and endorsements. There are also fewer restrictions on powerplants, including the formal adoption of electric power, with the only exception now being rocket motors! Whereas LSAs were subject to mandatory compliance with manufacturer safety directives (MSDs) and airworthiness directives (ADs), MOSAIC rules mean manufacturers and operators are only required to voluntarily comply with MSDs (ADs remain unchanged).

During the consultation period, the FAA noted that "rapid advances are occurring in aircraft automation and flight control technology," and that flight controls may "no longer resemble those found in traditional aircraft cockpits." Intriguingly, MOSAIC introduces a new criteria called 'simplified flight controls', which is considered by many to be a step towards allowing pilots to fly automated (or semi-automated) aircraft that are 'push-button simple' to fly.

Brazil's Montaer Aeronaves debuted its new MC-04 four-seater at EAA AirVenture event. A development of the two-seat MC-01, the all-metal aircraft has been optimised to comply with the new MOSAIC rules and is fitted with a ballistic parachute recovery system.

What is staying the same?

When it was first adopted, Sport Pilot gave new opportunities to those pilots unable to obtain a standard FAA medical certificate. This has been retained by MOSAIC, with pilots only requiring a current valid US driver's licence as evidence of medical eligibility for daytime flying (provided they have not had a previous FAA medical certificate denied or revoked).

While 'cost sharing' is allowed, pilots cannot carry passengers for hire. They can, however, conduct paid aerial work, such as infrastructure and forest inspections, photography/filming and agricultural surveillance for the first time.

A Sport Pilot can still go on to earn a 'full' Private Pilot Licence (PPL) with hours and experience from their LSA flying counting towards a PPL. They can also still take a one-off 16 hour course to learn how to inspect their aircraft and repair an Experimental Light Sport Aircraft (E-LSA) and this is now expanded to Experimental Amateur-Built (EAB) aircraft, including those built from kits and plans. Previously, unless owners were the original builder of the EAB (or held the specific repairman certificate for that airframe), they had to employ a qualified mechanic to perform inspections.

As of the end of 2024, FAA records showed that 7,309 pilots held a Sport Pilot certificate – just 1.5% of the approximately 500,000 pilots who hold private and commercial licences. The FAA, EAA, AOPA and other GA bodies in the US hope the long-awaited MOSAIC will mean the pieces fall into place for people to experience the fun of flying in a practical, safe and affordable way.

By the Numbers

Understanding the world of Aerospace through data

Apaches in service around the world

The iconic Boeing AH-64 Apache marks its 50th anniversary on 30 September 2025 (see 'The Apache's enduring reign' p26).

United States Army
824 (D/E)

Polish Land Forces
96 (E) on order

British Army
50 (E)

Israeli Air Force
48
AH-64Ai configuration

Egyptian Air Force
46 (D)

Republic of Korea Army
36 (E)

Saudi Land Forces and National Guard
34 (A/D/E)

UAE Joint Aviation Command
30 (A/D/E)

Hellenic (Greek) Army
29 (A/D)

Republic of China (Taiwan) Army
29 (E)

Australian Army
29 (E) on order

Indian Army and Air Force
28 (E)

Royal Netherlands Air Force
28 (E)

Kuwait Air Force
24

Royal Moroccan Air Force
24 (E)

Emirate of Qatar Air Force
24 (E)

Republic of Singapore Air Force
18 (D)

Japanese Ground Self-Defence Force
12 (D)

Indonesian Army
8 (E)

2,700 Apaches across all variants have been produced to date. Data correct at time of going to print.

Wayne J Davis/RAeS

Pushing the Envelope

Exploring advances on the leading edge of aerospace

Robert Coppinger

The potential of aluminium iron zirconium powder for 3D printing

Additive manufacturing, or 3D printing as it is commonly known, has garnered a huge amount of publicity for many years for its potential to replace centuries old, albeit now computer controlled, manufacturing processes.

Where parts were once formed by casting, forging and the use of lathes, they can now be created by fusing together particles of materials, with even large structures now possible. This has promised revolutionary change but the stringent regulations surrounding certification in the aerospace sector have stymied this otherwise apparently inevitable transformation of the means of production.

Two decades ago, 3D printing was seen mostly for rapid prototyping. Slowly, over the last 10 years, the US FAA and the EU's EASA regulatory bodies have paved the way for non-metal, metal non-structural and non-safety critical parts to be 3D printed and even engine components can now be produced. EASA's CM–S-008 certification memorandum for additive manufacturing was first issued in 2017, which was the same year that the FAA published an updated strategic roadmap for additive manufacturing.

The latter saw 'low criticality' parts being made immediately, with 'safety-critical' parts available in the near term and 'multi-material' products and even aftermarket 3D printed components available in the longer term. At the time, the US DoD was funding research to accelerate the certification and qualification of 3D printed metal parts but the expensive metallic and non-metallic powders needed, the high capital cost of the printing machines and the slow process times have also been barriers to widespread adoption.

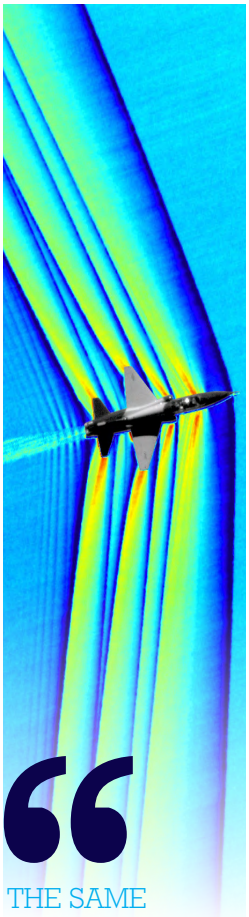
Lighter, faster, cheaper

Additive manufactured parts not only have to be as reliable as cast, forged or machined components, they must also be cost competitive. At the National Center for Defense Manufacturing and Machining (NCDMM) in Pennsylvania, a joint project with industry is producing datasets for a new aluminium alloy that could help reduce secondary operations for that metal. Allison Felger is Senior Project Engineer at the NCDMM, managing the $2.1m project to generate material properties data for the use of this new aluminium iron zirconium alloy for aerospace manufacturing.

"It was specifically designed for laser powder beds," Felger said. "It is a lightweight material [and] it tends to have significantly less post-processing time. It is showing better thermal stability over conventional aluminium alloys [and] we're hoping to further that research in this project." The research is being carried out using Californian firm, Nikon Advanced Manufacturing's multi-laser NXG XII 600 series powder bed fusion machine, which works with an initial layer of powder and, according to the design, a laser will fuse a pattern across that layer. The bed moves down and an additional layer of powder is added. The same design pattern is then fused, combining that layer together with the layer beneath, and so the process continues until the 3D part is completed.

The Aheadd CP1 aluminium iron zirconium powder is produced by the French aluminium specialist, Constellium. It has thermal and electrical conductivity properties that are "close to pure aluminium," Felger explained, adding that CP1 has also demonstrated "exceptional corrosion performance," and is compatible with "multiple chemical, electrochemical and hybrid surface finishing options." The NXG XII 600 series system produces small coupons of CP1 which are then tested to confirm the printing has delivered the desired properties. Felger said that the coupons go through tensile strength and fatigue testing, carried out in accordance with the standards of the American Society for Testing and Materials.

The project, funded by the Office of the Under Secretary of Defense Manufacturing Technology, is being guided by aerospace defence contractors, including Lockheed Martin, Northrop Grumman and Honeywell Aerospace Technologies. Felger explained that these companies participate in briefings and bring their "professional expertise input into the process because it is a research and development project … we're laying the groundwork for future work … we're developing the data set for basic data to tell us how to move forward." The project's results will be shared with the industrial partners of NCDMM.



> THE SAME DESIGN PATTERN IS THEN FUSED, COMBINING THAT LAYER TOGETHER WITH THE LAYER BENEATH, AND SO THE PROCESS CONTINUES UNTIL THE 3D PART IS COMPLETED

LETTERS

Putting the 'air' into the Air Cadets: a call to action

I was delighted to read the article 'Putting the 'air' into the Air Cadets' (*AEROSPACE* July 2025)[1] about the National RPAS Training Squadron, 2 FTS, RAF Air Cadets. That is not because I have a particular interest in RPAS but I am passionate about the RAF Air Cadets. Older readers may recall the Air Training Corps (ATC) from their youth but let me reassure you that the RAF Air Cadets is just the broader term for the ATC and Combined Cadet Force (CCF).

As a supporter of the RAeS, you wish to further the advancement of aeronautical art, science and engineering – but have you thought of doing so by passing on your passion to the next generation? If so I would urge you to get in touch with your nearest Air Cadets unit and, with 1,500 individual units, there will be one near you. Why not offer to visit for an evening and talk about your job? Whatever you do in the aeronautical family you will be given a warm welcome – but do not be surprised if you get some incisive questions.

Of course, if you could volunteer to work with the Air Cadets that would be even better. We have 10,000 volunteers – both in and out of uniform – but many of us do not have the direct connection with STEM and aerospace that you probably do. For example, in my unit I am the only aeronautical engineer, current pilot and former member of the RAF. The rest of the team is passionate about our work and has a wide range of skills.

Triggered by immediate Past-President David Chinn's Design, Build, Fly theme, I set up an agile project for our cadets that saw them design, build and fly an aircraft (albeit mostly made of paper) as far as possible, carrying as much payload as possible and as cheaply as possible.

Six months in, they are still going strong and learning lots about project management, aircraft design and cost control, while also having lots of fun.

Sqn Ldr **Alan Ferguson**, MRAeS,
1249 (Dereham) Sqn Air Cadets

ONLINE

Shape of wings to come?

Response to 'History repeating itself? As the KC-135 predated the 707, can JetZero turn its BWB tanker into a next gen airliner?'[2]

Gary Vermaak The USAF has just put in a massive order for KC-46 tankers so I do not think the prospects for BWB tankers are bright.

Richard Wilson I view such configurations as an aerodynamicist's dream! Although it would be great to see one fly, once you dial in the solutions to its many challenges I suspect that the remaining fuel burn benefits don't justify its very probable substantially higher total operating costs.

James Alderman This aerodynamicist is not a fan either. When looking into these configurations some time ago the aerodynamic challenges I recall included low wing loadings, suggesting high cruise altitudes and the predominant gust condition at cruise was not 2.5G but somewhat higher.

Unless it is a very big aircraft the centre section was prone to strong normal shocks. Low sectional loading did help. They are a fun configuration to look into though as it feels aerodynamically the 'right' thing to do as everything is integrated and lifting. Of course the conventional tube fuselage does generate lift so is contributing to the optimum span loading.

Malcolm Foster And we have not even mentioned the issues related to pressurisation.

Stephen McParlin I concur about the shortcomings of BWB designs. The moment you lose the tailplane, the aerodynamic design of the rest of the vehicle becomes compromised by the need to generate longitudinal stability and trim, and for a stable aircraft that means a poor high-lift system, limited trimmable CG range plus inadequate control power for both take-off rotation and pitch-down authority at higher alpha. The distribution of mass and inertia is also problematic. The lack of pitch damping means that you need active control to stop the SPO exciting the phugoid… while increased inertia about the yaw axis implies some 'interesting' Dutch roll characteristics. A combination of poor stall characteristics, lack of pitch control authority and lower pitch inertia versus higher roll inertia all point at wing drop feeding into an inverted flat spin being a likely consequence. It is not an aerodynamics issue; it is a controllability issue.

Talk to me, Goose!

Response to 'New RAeS Journal of Aeronautical History paper asks if the F-14's aerodynamics were to blame for Goose's death in the classic 1986 movie, *Top Gun*?'[3]

Robin Trewinnard-Boyle If Iceman had pulled off to the right like Maverick told him to (rather than pull up vertically), then Mav would not have flown through the jetwash and the aerodynamic issues wouldn't even have factored! How that never came up in the court martial is beyond me, with Iceman never taking any responsibility and eventually getting promoted to Admiral... (Yes, I know it is just a movie).

Dudley Henriques I can attest that an F-14A was tested for flat spin mode at Strike at the Naval Air Test Center back in the 70s. One of the spin modes tested resulted in an unrecoverable upright spin. The pilot ejected successfully, although under -7G and the RIO (in the back over the spin axis) ejected with no issues.

Both crew members lived through the experience and the aircraft after recovered itself before impacting the water. Investigations revealed that the force of the ejections countered the inertia spin mass and recovered the aeroplane. The film has long been used in a safety format – hopefully it has saved some lives over the years.

Productionising EAP

Response to 'On this day in aviation history, on 8 August 1986, the British Aerospace Experimental Aircraft Programme (EAP) took to the skies on its maiden flight.'

Dale Shakeshaft Could EAP have made it into service as a stand-alone project or was it too experimental?

Neil Chavner EAP had features, such as a Tornado fin and undercarriage and RB.199 engines. Replace those and you basically have the Typhoon. It was delayed for years by Germany's post-Cold War hesitation.

Martin Bayliss The main difference is that Germany insisted on a simpler wing which reduced the Typhoon's top speed and manoeuvrability, compared to the EAP. The UK really should have gone it alone and productionised the EAP. It would have entered service at least a decade earlier and would have been much more widely exported.

Robert Hencher This is why I am glad we have got the Japanese on board with GCAP. Tempest cannot take as long to get into service and hopefully the Japanese will drag the UK kicking and screaming to get the job done on time.

Graeme Gladwinfield Proud to have been one of the airframe engineers on EAP. I stood on the apron with son of the test pilot (Dave Eagles) watching its first take-off.

Tony Murrell I was on a course at Warton and watched its maiden flight.

An ATP by any name

Response to 'On this day in aviation history, on 6 August 1986, the British Aerospace Advanced Turbo Prop (ATP) took to the skies on its maiden flight.'

Paul Glover We had them at BMI and they became known as the Advanced Technical Problem.

John Horton ATP was known by many names including: Avro Taking the Pi$$, Ancient Technology Perpetuated, Apprentice's Turbo Prop, Wigwam (because it is 'A Tepee'). ATP was also rendered by some as 80p (or by extension Sixteen Bob by those who could remember pre-decimal currency) as it was claimed that was all they were really worth. Advanced Tato (Potato) Pie was an in-joke at Woodford, after someone transferred from catering to production. Perhaps most imaginative of all though was Parrot or New World Parrot, because it was essentially a bigger HS.748 Budgie, and all too often as 'sick as a parrot' too!

Experimenting works

Response to 'Do X-plane experimental demonstrators really help deliver aircraft programmes 'at pace'?[4]

@dragonat60 Things may look good on the VR, but 'real life' often throws up details and changes can be made. That is why we still need an early model as a demo.

SCAF: Dead on arrival?

Response to 'Does the mood music from Europe mean the end of the continent's multinational SCAF future fighter programme?'[5]

@mahonj They would be better off concentrating on drones and cruise missiles (thousands of them). It is like they are building airships in 1938. Look at Ukraine to get a vision of the future.

@epelgrino Trappier, in his last interview, mentioned real technical challenges for Safran to come up with an engine thrust sufficient enough to push a 33-34t loaded airframe.

@GripenNews Airbus should stand down. Only two countries in the EU can design fighter jets within reasonable costs: France and Sweden. The other nations should first agree on operational requirements, give Dassault design lead, then decide on the work share.

@NicolasLDavout I know I am biased because I am French – but Dassault has a point. The standard European governance model for defence produces expensive equipments, out of schedule and with requirements that never fit the needs of everybody. The Eurodrone is a prime example. Germany can take the lead on the future main battle tanks.

Dispersed F-16 ops

Response to 'With a few vehicles and some smart thinking, can you turn F-16 base doctrine into Gripen-style dispersed ops?'[6]

@BO3673 Persistence seems to be key in Ukraine. If you can remain dispersed the mere threat of you popping up may be a very strong influence on how hard the enemy presses you.

@TeroTweet It is the only way to survive! The Finnish Ilmavoimat has been training dispersal ops from roadbases and secondary airfields for decades. First with MiG-21s and Drakens, now with F/A-18 Hornets and, in the future, with our F-35As.

A bag for life

Response to 'Videos show people evacuating burning airliner in Denver with their hand luggage.'

@robareback If I am on a aircraft that is evacuating, and you are getting your bag, I am going over or through you! That said, you should consider flying with your ID and money on your person so you do not feel so compelled to get your bag.

@timba_captain All luggage coming off the aircraft during an evacuation should be confiscated and destroyed. That will put an end to this selfish idiocy.

@MichaelJPryce It is notable how many topple over when getting up at the bottom of the slide, possible due to lugging a bag. Many also go straight to their phone while they are still in the smoke! No bag, no shoes - or just no clue!

Türkçe Typhoons

Response to 'UK and Türkiye sign MoU for potential Typhoon purchase. A massive boost to UK Typhoon production line in Warton.'

@BeaverWestminst This is geopolitically important – government to government, air force to air force and industry to industry.

@MartinStrumpfer I guess that is one way of keeping Warton busy until GCAP comes. Get another MoD to support them!

@mattfle02898557 New ones or are we selling some of ours to them?

@areid602 Both. Osint sources suggest some of the RAF's just retired Tranche 1s will be donated for training purposes – and be flying with the Türk Hava Kuvvetleri in 2026. Then 20-24 new builds will be assembled at BAE's Warton facility.

FCAS Demonstrator

Response to 'Work under way on Future Combat Air Demonstrator. In the age of digital twins and high fidelity simulation, why is the UK building a supersonic technology demonstrator?'[4]

@pmathia0 Theory will only get you so far.

@FacelessManTwit Digital twins do not behave like the real deal in the air, as Boeing has learned the hard way from the T-7A fiasco, forcing them to redesign T-7A and start over testing which threw out around 700 hours worth of flight data.

@ValkStrategy I would stress the 'capstone' idea. You do not want a news story in 2035 to begin: "A problem quickly emerged because Typhoon development had spanned the late 1980s and 1990s, and even senior leaders on GCAP had no experience of building a complex new aircraft from scratch."

Finding the right blend

Response to 'With JetZero and Outbound Aero both having flown subscale prototypes, are BWB the future shape of airliners?'[2]

@jgarth22 Not until they relax the requirement to egress an aircraft in 90 seconds with the exits on one side inoperable.

@ian_bill67 I took part in some trial emergency evacuations on a mocked up BWB at Cranfield.

@Julianspoiler Do you see any certification risk, such as crosswind, low speed high AoA behaviour or icing formation?

1. aerosociety.com/news/putting-the-air-into-the-air-cadets/
2. aerosociety.com/news/finding-the-right-blend/
3. aerosociety.com/publications/jah-goose-didn-t-have-to-die-the-evolution-of-lateraldirectional-departure-metrics-and-the-design-of-the-f-14a
4. aerosociety.com/news/the-quick-and-the-dead-20-can-a-demonstrator-speed-up-britain-s-next-fighter/
5. aerosociety.com/news/scaf-dead-on-arrival/
6. businessinsider.com/ukraine-new-way-keep-f-16s-moving-strategy-west-looking-2025-7

The UK and Europe can lead the next technological revolution and have a central role in the global world order.
Space is at the heart of it.
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Space for growth

Space came to Manchester in July. **KATE ARKLESS GRAY** reports from the UK Space Conference.

The UK Space Conference took place in Manchester on 16-17 July over a busy couple of days that saw the city host space executives, rub shoulders with newly minted graduates in gowns and Oasis fans in bucket hats as they ran for shelter from the rain. A bit of bad weather was not enough to dampen the spirits though, and, despite not getting a ticket for one of their home gigs, even the Rosalind Franklin Mars rover was seen sporting an Oasis hat.

There was a lot to be positive about at the conference which had the theme 'Space for Growth' running throughout. From funding announcements to lively discussions and a bustling exhibitor hall, there was a real sense that space is gaining proper recognition as critical infrastructure in the UK. The presence of UK Minister of State at the Department for Science, Innovation and Technology and the Department for Culture, Media and Sport, Sir Chris Bryant, Mayor of Greater Manchester, Andy Burnham, and Scottish Minister for Business and Employment, Richard Lochhead indicated that those in power are taking note of the benefits and opportunities that the sector can bring.

Yet, despite these positive signs, there was also a tangible undercurrent of frustration, be it confusion about the multitude of sources of funding and organisations to engage with, the lack of a joined-up approach to communicating the benefits of space in the UK or concerns around attracting and developing talent in the sector.

UK Space Agency

Nevertheless, UK Space Agency (UKSA) CEO, Dr Paul Bate was upbeat, announcing news of an additional £1.6m of funding for the space clusters around the UK and £4.5m for four innovative projects from MDA Space, Orbit Fab, SSTL and Viasat.

"Space tech is deeply embedded in the UK and global economy," said Bate, pointing to the fact that 18% of UK GDP is underpinned by, or reliant on, space and satellite services. He declared the direct economic return from every £1 the UK contributed

▲ Rafel Jorda Siquier, CEO and founder, Open Cosmos, at the UK Space Conference.

to the European Space Agency (ESA) was £7.49, according to a new report.

"We have a strong story to tell," he said, adding that there is still work to be done with companies reporting a shortage of skilled workers, growing competition from Europe and the need for a more connected approach. There is a move toward a 'one government' concept, with space now central to government thinking, he said.

This was echoed by Sir Chris Bryant, Minister for Space and Telecoms, who said: "It's vital that we are co-ordinating right across government to unlock space's incredible potential."

"Our focus must be on three priorities: national security, economic growth and leveraging UK advantages, such as launch capabilities," he added.

European Space Agency

Over at ESA, its Director General, Dr Josef Aschbacher, was happy to report that investment in European space is coming not just from the public sector but increasingly from the private sector. However, in terms of public investment in space, he warned that Europe is lagging behind other countries. "The good news is that Europe is efficient in using its funding and very successful in developing some of the world's best missions," he said. He praised UK involvement in the James Webb Space Telescope (JWST), Aeolus, Moonlight, the European Launcher Challenge, ExoMars, Biomass and Vigil.

With the current turbulent geopolitical environment, the topic of space and defence came up repeatedly during the conference. Dr Aschbacher recounted the deep discussions that were had at ESA Council last year on what the ESA convention allows them to do regarding defence and dual-use technologies. "It was made crystal clear that we can work on defence without any question," he said, "but what we cannot do and will never do, is work on weapons of aggression."

> IT WAS MADE CRYSTAL CLEAR THAT WE CAN WORK ON DEFENCE, WITHOUT ANY QUESTION, BUT WHAT WE CANNOT DO AND WILL NEVER DO, IS WORK ON WEAPONS OF AGGRESSION
>
> **Dr Josef Aschbacher**
> Director General, ESA

Funding growth

With 'Space for Growth' the theme of the conference, Rafel Jorda Siquier, Founder and CEO of Open Cosmos commended the UK's role in the Industrial and Digital revolutions and made an impassioned plea for the UK to be a pioneer of the Intelligence Technology revolution. He called for the *Modern Industrial Strategy*, *Strategic Defence Review* and *Mansion House Agreements* (that allow pensions to be invested in high-growth areas and companies) to move from strategy and agreement into action. "Now is the moment to play our part," he said.

Following this rallying cry, Anita Bernie, Managing Director, MDA Space UK claimed that, despite creating pioneering companies that helped fuel the Digital Revolution, "we didn't work hard enough to keep ARM and Deep Mind in the UK." On the subject of dual-use space, she said: "Prosperity and security are two sides of the same coin. We have to recognise that if we don't have security, we won't have prosperity."

"Other nations do a really good job of communicating that," she continued. "One of the most important things would be having a single focal point, or single voice at Cabinet level, that can promote that message for us," she suggested. "At the moment it's just not landing and people don't want to stray into dual- use as they think it's a problem but actually it's really important."

There was also a consensus that partnerships will be vital to maintaining a vibrant ecosystem. Kate Robson Brown, VP Research, Innovation and Impact at University College Dublin, highlighted the many ways that universities can bring value "but what we can't control is university resilience." She warned that a funding crisis means they are facing a lack of sustained funding across years, which is what space projects require. Meanwhile, Stephanie Ayres, Head of Policy at UKspace, highlighted a huge range of potential funding for the sector but questions were asked about how accessible funding is and the scope

▼ ESA astronauts Tim Peake (centre) and Rosemary Coogan (far right) at the ESA Vigil mission press briefing.

ESA/Will Clarke

UK and France
collaboration on climate
The model you see here shows the joint CNES (French Space Agency) and
UK Space Agency mission, MicroCarb, expected to launch in July 2025.

of what it can be used for, depending on the source of funds.

RAeS President-Elect, Prof Malcolm Macdonald sees an opportunity for the Society to help the UK meet its potential in space. "I think the *Modern Industry Strategy* gives the space and aerospace sectors some much needed clarity," he said. "Both sectors feature in the *Advanced Manufacturing Sector Plan* and we heard clear statements recognising the sectors will be critical to the *Defence Sector Plan*."

"It's great that the contribution of the space sector to our economy, our way of life and our national security is being recognised but this also emphasises the need to ensure a strong supply of suitably qualified and experienced people if this growth potential is to be realised. I believe this is an area where the RAeS has a vital role to play in supporting the continuing development, sustainability and diversity of our sector."

◤ Director General, Dr Josef Aschbacher and his European Space Agency colleagues during the show. Aschbacher warned that, in terms of public investment in space, Europe is lagging behind other countries.

◥ A model of MicroCarb satellite, which has the ability to map CO^2 emissions over cities and help plan sustainable urban areas in future.

▼ RAeS President Elect Prof Malcom MacDonald (right) with Ed Fyfe, Ed Fyfe Design (centre) and Alan Thompson, Head of Government Affairs, Skyrora (left).

Funding confusion

With a list of new bodies for industry to engage with including the Space Industry Advisory Group, Defence Innovation Unit, Strategic Public Investment Forum and Commercial Innovation hub, Bernie said: "I feel a sense of confusion, frankly, that there are so many organisations that we need to tap into. My call to action back to these organisations is how can they make it easy for us to connect with them? They need our capability, our skills, our talent."

Dr Emma Haynes, Partnerships Director, NPL, agreed: "Frankly, I find it horrifying that we keep standing up more acronyms that just become more and more difficult to navigate," she said. "If we create more and more bureaucracy, make it harder and harder for firms to access the funding and the skills and the support, then I think we're doing it wrong. Let's not have silos, let's not have bureaucracy and let's not have any more acronyms."

Day One without space

Following a live link into the Chief of the Air Staff's Global Air & Space Chiefs' Conference, Col Chris Fogarty, Head of UK Space Command, joined Harshbir Sangha, Missions and Capabilities Director, UKSA, to discuss threats to space-critical national infrastructure (CNI).

Fogarty described space as "the fifth domain of warfighting" and noted the increase in hostile threats to space infrastructure that keep him up at night. "We need to recognise our dependence on space," he said, adding that close collaboration and understanding between Space Command and the UKSA is important for building resilience.

He talked about a recent joint exercise called 'Day One Without Space', which brought government, military, industry and academia together to consider the impact of a threat – such as space weather – preventing access to space assets for a limited period. The exercise was

ESA/Will Clarke

At CM25, ESA will deliver a package to ensure we:
1. Protect our Planet and Climate
2. Explore and Discover
3. Strengthen European Autonomy & Resilience
4. Boost Growth and Competitiveness
5. Inspire Europe
ESA STRATEGY 2040

intended to help those with 'space blindness' to realise how sectors, such as agriculture, finance and transport all heavily rely on space to work properly.

Sangha said the exercise highlighted the lack of knowledge about space in the UK and raised questions about how you can increase the understanding of space and its impact, and how you prepare the public for a time where space resources and data are not accessible. It is not just hostile threats but the challenges of space debris, space weather and even launch that we need to consider.

Fogarty advised businesses to ensure that their continuity plans include a section on what to do if you are denied space services and said the military is starting to apply education to every level of training so that everyone is upskilled on their reliance on space.

Sangha added that another challenge is that space is moving so fast. "How do we ensure that the regulatory environment moves as fast as the space industry is moving?" he asked, before adding that "it's not down to the agency or the MoD to try to do everything. It's a collective thing we need to do working with businesses."

Momentum for launch

With space being recognised as part of our CNI and launch capability specifically mentioned in the government's *Modern Industrial Strategy*, Richard Lochhead MSP, talked about the momentum for launch in Scotland, saying that it was "a watershed moment for our country."

It was recently announced that UK company, Orbex made it onto the shortlist for ESA's European Launcher Challenge with Rocket Factory Augsburg (which also plans to launch from Scotland) making it through to the final five as well.

Orbex CCO, John Bone said the company is looking forward to its first launch next year and is actively wanting to hear from the defence community to understand what its requirements are for launches. He hopes that in five years' time it will be launching its larger rocket, Proxima, which can take 4.5 tonnes to Low Earth Orbit, but the launch site is yet to be decided. It is looking at whether it is safe and feasible to launch from Scotland or not.

▲ From left to right:

The Royal Astronomical Society's Supermassive Podcast recorded with ESA's Tim Peake, Meganne Christian and John McFall at the event, asking 'Why send humans to space?'

ESA Director General, Dr Josef Aschbacher.

RAeS President Elect Malcolm Macdonald and Membership Development Officer Kelsey Bauley on the Society's stand.

▼ Mayor of Greater Manchester, Andy Burnham (left), with UKSA, CEO Dr Paul Bate.

Skills development

In a first for the UK Space Conference, there was a dedicated session on skills and workforce development.

"Space is no longer a 'nice to have;' it's a must have," emphasised Prof Anu Ojha, Director of Championing Space at the UKSA, adding: "we are

All: Kate Arkless Gray unless stated

▲ 'Champagne Super Rover in the sky...?' With Oasis playing in Manchester on the same day as the conference, even the Rosalind Franklin Mars rover was seen sporting the band's trademark hat.

competing in a larger field of careers and we need to be more assertive and proactive."

"Inspiration is an easy word that is used way too often," he added. "It's great for a photo-op or a soundbite, but how much strategic prioritisation is actually given to it? How much resource is given to it? How much sustainability, political platforming is given to it?" he asked.

Prof Lucy Berthoud from the University of Bristol asked industry to heed her warning that, with increasing numbers of international students on STEM courses in the UK, there are fewer places for domestic students and in a few years' time the industry might face a problem since visa issues mean that we cannot keep the talent from overseas that we have invested in.

The biggest skills gaps are in software, data and AI where we are competing with the technology sector, said Joseph Dudley, Director, Space Skills Alliance.

However, there could be opportunities for a 'brain gain' from the US, given the funding uncertainty that space professionals, academics and researchers are facing in the US, he said.

The future of the UKSA

During networking breaks one hot topic of conversation was the future of the UKSA and whether it would survive the current government review into arms-length bodies (ALBs) or be absorbed by the Department for Science, Innovation and Technology (DSIT). Speaking in the House of Lords, Baroness Anderson of Stoke-on-Trent said there was "a presumption that they will be closed or merged or have functions returned to government departments unless justified."

Responding to a question about the agency's future, a UKSA spokesperson stated: "In April, the Cabinet Office commissioned a review of ALBs across government. There are more than 300 ALBs in total, employing around 400,000 people. The UKSA is one of 16 ALBs of DSIT. The outcome of the ALB review will be announced in due course. Whatever the outcome, the UKSA and DSIT Space Directorate will continue to work closely together and champion a more coherent, 'one government' approach to supporting the space sector and delivering on our shared priorities."

Monitoring climate change

Other notable moments at the conference included a briefing on MicroCarb, a joint UKSA/ Centre national d'études spatiales (CNES) mission which launched in the early hours of 26 July. This is the first European mission to map the sinks and sources of carbon dioxide and has the ability to map CO_2 emissions over cities, which could feed into more sustainable urban planning in future. Data from satellites, such as MicroCarb, is used to monitor our progress towards the goals of the *Paris Climate Agreement*.

Having recognised space weather as a critical risk to the UK economy, the UK is leading on ESA's Vigil mission, which is set to launch in 2031 and will vastly improve our ability to predict and mitigate against it.

When operational, Vigil's position will allow it to predict earlier solar events that might impact Earth and deliver more accurate and timely forecasts. Given the potential damage to satellites, astronauts, aviation and ground-based power infrastructure caused by space weather, an accurate advance warning system is vital.

Overall, there was a sense of cautious optimism in Manchester and an appetite to tackle issues head-on and move the UK space sector forward. "We should never forget the ability of space to inspire and challenge us and bind us in common endeavour," concluded Dr Paul Bate. "Every nation shares a border with the cosmic coastline. Space is a team sport."

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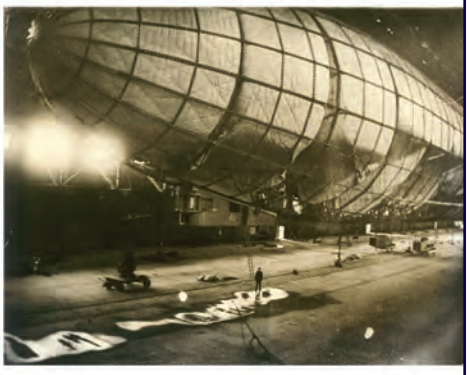


Timings & Tours

14 September: 10:00-16:00, Tour & Talks at 10:00, 11:30, 13:30, 15:00
21 September: 10:00-16:00, Tour & Talks at 10:00, 11:30, 13:30, 15:00

Location

The National Aerospace Library, The Hub Q134, Fowler Avenue, Farnborough, Hampshire, GU14 7JP

To find out more about Heritage Open Days, please visit: https://www.heritageopendays.org.uk/

Would you board an AI-piloted airliner?

How do we balance trust, safety and innovation in aviation when it comes to autonomous systems with safety-critical functions? Dr **RASHID ALI** FRAeS, Future Transport Engineering, Coventry University and Chair of the RAeS C3 Specialist Group, considers the key issues.

There are two types of analyses: qualitative and quantitative. We engineers mainly deal with quantitative data, but qualitative data can also be used effectively to arrive at robust conclusions. As an academic, I run a three-hour seminar on qualitative data analysis and on one occasion I requested the organisers not to divulge my identity. When I entered the seminar room, 24 postgraduate students were waiting for me including nurses, lawyers, accountants, managers etc, but not a single engineer. As such, this was a perfect setting to demonstrate to the participants the power of qualitative data.

I placed a pen and sheet of A4 paper in front of the students and asked them to write three or four responses – either for or against – an idea that I put up on the screen. This secrecy was to ensure that the participants could not look me up, or my interests or background. This ensured total elimination of researcher bias in the responses. The data I collected was without bias and is presented as actual responses in this article in *italics*.

For the purposes of this article, I have rendered my thoughts and deductions as a story that unfolds at an airport terminal. The participants become the passengers and their responses pivotal in formulating the argument.

> PEOPLE DO NOT TRUST WHAT THEY DO NOT UNDERSTAND

Ready for boarding

The airport was alive with the usual pre-flight commotion—families saying their goodbyes, business travellers finalising work calls and tourists eagerly preparing for their journey. However, as passengers waited to board their flight to New York, an unexpected announcement changed the atmosphere entirely:

"Ladies and gentlemen, Flight 205 to New York is now ready for boarding. Passengers are requested to board the aircraft by zone numbers, we are calling passengers in Zone 5 to come forward. Please note that this flight is operated entirely by a computer with no human pilot on board."

For a moment, silence filled the gate. Then came the murmurs of confusion, concern and outright fear. Some passengers exchanged uneasy glances, while others voiced their worries aloud. The overwhelming response was one of hesitation and mistrust. Despite decades of advancements in automation, many people still struggle to place their lives in the hands of artificial intelligence, especially at 35,000ft.

Fear of the unknown

One of the strongest reactions from passengers was uncertainty. The announcement felt like an experiment, and most people do not want to be test subjects when it comes to their safety. *"Would this be the first time?"* one passenger asked nervously. Others assumed outright that AI-piloted flights had never been done before, making the risk seem even greater.

A common concern was the comparison to self-driving cars, with one traveller noting: *"They still have accidents."* While autonomous systems have made progress, high-profile failures in self-driving technology have made people sceptical of AI handling something as complex and high-risk as flying an aeroplane/aircraft.

Another passenger simply pointed out how unfamiliar it felt: *"This is not a common method for passenger transport."* That lack of precedent was enough to trigger unease. People trust what they know and, right now, fully autonomous aeroplanes remain an untested concept in commercial travel.

The role of safety testing

The key to overcoming these fears lies in transparency and rigorous safety testing. Passengers want proof: *has this technology been tested thoroughly? Have there been real-world trials? What safeguards are in place?* Without clear answers to these questions, trust cannot be built.

Aviation authorities and airlines must ensure that AI-driven flight systems undergo the same (or even more rigorous) certification, stress testing and redundancy checks as human pilots. Until the public is reassured of extensive real-world testing and foolproof safety measures, fear of the unknown will remain a major barrier.

Trust in human judgement

Even those familiar with modern aviation systems were uncomfortable with a fully pilotless flight. One traveller pointed out: *"Aeroplanes fly by computer anyway, with minimal human action required but a human is always present."*

Embraer

▶ At the 2024 National Business Aviation Association event Embraer and Bombardier provided a futuristic vision of an AI-piloted business jet.

This highlights a key issue: people trust AI as an assistant but not as the sole decision-maker. While automation can handle routine flying, passengers need to know that, if something goes wrong, a human is there to take control. Several passengers voiced this exact concern:

- *"What if something goes wrong? I like the idea of a human being there to problem-solve."*
- *"Computers are heavily involved in flying the aeroplane so what is the risk? I will fly but only with human pilots on board."*
- *"If anything goes wrong, can a computer really make the right decision?"*

Building trust in AI decision-making

AI may be able to react faster than a human in some cases but can it think critically in unforeseen emergencies? That is the core of the trust issue. To address this, AI flight systems must:

- Undergo extreme real-world testing in simulated and live conditions.
- Demonstrate their ability to handle rare and complex emergencies.
- Be paired with a fail-safe human oversight system, at least initially.

People will not trust AI pilots simply because the technology exists. They need to see proof, they need to see trials, and they need to know there is a back-up plan.

> WHEN IT COMES TO AVIATION, PEOPLE ARE NATURALLY RISK-AVERSE

Feeling misled: the importance of transparency

As the reality of the situation set in, frustration began to build. Many passengers felt that they had not been given enough information beforehand. *"I was not informed upfront,"* one person complained. Another added: *"No prior warning was given."*

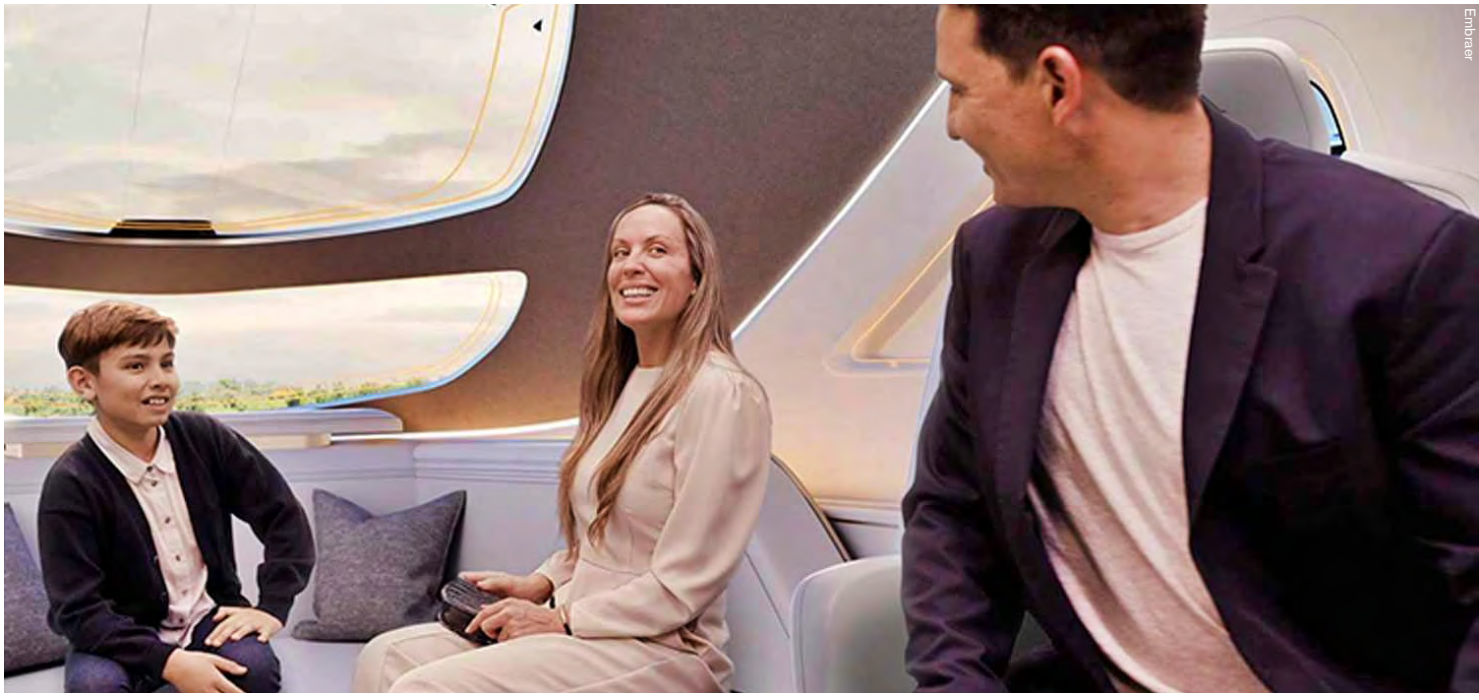
For some, the issue was not just AI itself – it was how the information was delivered. They were not given a chance to process the idea, ask questions or weigh the risks before arriving at the airport. Instead, it was presented as a last-minute surprise, which only heightened their anxiety. Others were frustrated by the lack of technical reassurance:

- *"No verification of technology and methods."*
- *"Not enough information, such as will there be a standby human pilot?"*
- *"Computer has not been tested fully to assume it is safe."*

The role of clear communication

Airlines and aviation authorities must make public trust a priority. This means:

- Early and clear communication about AI flight operations.
- Providing passengers with full details about safety measures.
- Holding public demonstrations to showcase AI's capabilities.


Embraer

▶ Driverless cars still have accidents – is the world ready for pilotless passenger aeroplanes?

LHP Engineering

People do not trust what they do not understand. If airlines want passengers to feel safe, they must invest in education, transparency and public engagement long before AI-piloted flights become the norm.

The risk factor

For many passengers, this was not just an interesting new technology – it was a matter of life and death. Some made their decision immediately:

- *"I refuse to be an experiment."*
- *"No, I will not take the risk because I have children."*
- *"It is highly risky for just a holiday."*

When it comes to aviation, people are naturally risk-averse. If a flight operated by a human has a 99.999% safety rating, but an AI flight is new and unproven, many will choose the known option – even if the risk is only slightly higher.

◀ Embraer and Bombardier vision of an AI-piloted business jet includes a cabin with three zones, including passenger seating where the cockpit is traditionally located.

How to overcome the risk perception

- Demonstrate AI safety through real-world trials.
- Introduce AI pilots gradually, rather than suddenly removing human pilots.
- Make AI systems highly redundant, with multiple fail-safes.

Over time, as AI pilots prove themselves in real-world operations, public confidence may shift. However, for now, many passengers are unwilling to take the leap without proof of absolute reliability.

Earning public trust

This moment at the airport highlights an undeniable truth: technology alone is not enough – trust must be earned. For AI-piloted aeroplanes to gain public acceptance, airlines and regulators must focus on three key pillars:

1. **Safety**: AI must be tested to the highest standards, with redundant safety systems and real-world trials proving its reliability.
2. **Transparency**: Passengers need clear, early communication – not surprises at the gate. Public trust grows when people understand how AI works and why it is safe.
3. **Gradual adoption**: AI should be introduced alongside human pilots first, allowing time for people to adjust and gain confidence before moving to fully autonomous flights.

Right now, the biggest question in passengers' minds remains: *"If something goes wrong, who will take control?"* Until that question has a widely accepted answer, airlines will struggle to convince people to board an AI-piloted flight. Trust must be built, not expected.

The Apache's enduring reign

As it approaches its 50th anniversary, the AH-64 Apache family remains the premier Western attack helicopter, but while it has been continuously updated **JACK RICHARDSON** asks if the changing face of the battlefield is finally catching up with the gunship.

As armed forces and industries across the world race to develop sixth-generation fighter aircraft and ever more complex drone systems, less attention has seemingly been paid to rotary-wing aircraft. While innovation does continue in this area, one platform has been a solid presence for half a century.

On 30 September 1975, Robert G Ferry and Raleigh 'Bud' Fletcher lifted the prototype Hughes YAH-64 into the air for its maiden flight – just a day before the rival Bell YAH-63. Built to replace the Vietnam-era Bell AH-1 Cobra, the helicopter would become the AH-64 Apache, passing to McDonnell Douglas when the company acquired Hughes in 1984 and, in turn, Boeing in 1997 when Boeing and McDonnell Douglas merged. Over the years, the aircraft has evolved to meet changing threats around the world and is showing no signs of stopping yet.

Entering service in 1984 as the AH-64A, the Apache's original planned role was countering Soviet tanks in Europe. As well as a 30mm cannon and unguided rockets, it was designed to use the Helicopter Launched, Fire and Forget Missile (Hellfire) weapon. James Murrell, Apache Experimental Test Pilot at Boeing, described the aircraft's journey to date: "Each evolution of the Apache – from the AH-64A to today's AH-64E – has delivered advanced attack helicopter capabilities that are operationally proven, mature, low-risk and optimised for readiness."

The helicopter gunship came of age as a concept during the Vietnam War with the Cobra being used to attack North Vietnamese forces. However, when the war ended and the emphasis shifted from Southeast Asia back to Europe, a larger and more powerful platform was needed to tackle the pre-eminent threat of massed Soviet armoured formations attacking over diverse terrain, potentially at night.

The aircraft made its operational debut in 1989's Operation Restore Hope in Panama but it was in the Gulf where the aircraft earned its main operational spurs. Operation Desert Storm was launched to liberate Kuwait in January 1991 and the opening salvo was fired by US Army Apaches carrying out low-level strikes against an Iraqi radar site, allowing the wider allied air campaign to commence.

> "THE APACHE IS A FORCE MULTIPLIER, ENABLING GREATER LETHALITY, SURVIVABILITY, REACH, SITUATIONAL AWARENESS AND ADAPTABILITY THAN UNCREWED SYSTEMS CAN ACHIEVE ALONE

Longbow

Following the Gulf War, the Apache undertook its first major upgrade. The new AH-64D Longbow Apache featured improved engines and avionics, updating the A model's cockpit – which had 1,200 switches - with multi-function displays and cutting the number of switches to 200, bringing a largely analogue helicopter into the digital age.

The D model's flagship upgrade, however, came in the form of new Longbow radar, leading to the new designation 'Longbow Apache'. Mounted above the rotors, this detachable sensor can detect, locate and classify up to 256 simultaneous moving and stationary targets, processing them in seconds to present to the crew the 16 most dangerous. Crucially, this allowed 'fire and forget' operation for the Hellfire missile, as well as integrated communication with other assets.

It was not long before the Longbow Apache saw action, with the aircraft rapidly deploying to Kosovo in 1999 as part of Operation Allied Force. However, it was following 9/11 that the aircraft saw the bulk of its use, with US Army Apaches deploying to Iraq at the height of the counterinsurgency campaign.

However, it would be in this theatre where another facet of the Apache's high technology emerged, with gun camera recordings becoming part of the high-profile pieces of information leaked by Edward Snowden, demonstrating how modern equipment can have its own role in altering the perceptions and conduct of war.

UK Apache force

During the later war in Afghanistan, the Apache once again found itself operating in a very different environment from the one for which it had been designed. For the British Army, an early export customer for the type, this is where the aircraft had its operational debut, flying a variety of missions from close air support to pre-planned strikes and convoy escort, notably being flown by Prince Harry during his service with the Army Air Corps.

Despite the very different nature of the conflict, the aircraft's sensors proved especially valuable with the Longbow radar able to classify potential threats and then enable closer inspection using the optical sensors, thereby preventing unnecessary civilian casualties.

In total, the UK purchased 67 Apaches, most of which were built under licence at the then AgustaWestland facility in Yeovil and fitted with Rolls-Royce Turbomeca RTM322 engines among other enhancements, including improved countermeasures. Designated the WAH-64 and operated by the Army as the Apache AH.1, the British machines also had the ability to operate at sea thanks to their folding rotor blades, a capability that was proven operationally in 2011 when the type prosecuted a variety of targets along Libya's coastline while operating from HMS *Ocean*.

Earlier this year in March, the 50th remanufactured AH-64E was delivered to the UK Army Air Corps from Boeing's Mesa Arizona, production line, completing an upgrade from the WAH-64 fleet. Murrell described this as his favourite memory of flying the Apache, having done so since 2004. "Testing the aircraft, knowing the increased capability was heading to the British Army was a great experience and one I'll cherish," he said.

Apache Echo

Like previous upgrades, AH-64E features upgraded engines, now combined with a new composite

Stephen Bridgewater/RAeS

rotor and compatibility with Link 16. However, perhaps the biggest change is in what the crew can now do outside of the helicopter as the 'Echo' is equipped with the ability for the crew to control UAVs. This allows a crewed-uncrewed teaming arrangement where UAVs, such as the MQ-1C Gray Eagle and RQ-7B Shadow V2, can scout ahead and designate targets for the Apache, allowing the crew to control both the drone and its sensors while maintaining a safe distance. Murrell explained the significance of this, saying: "the Apache is a force multiplier, enabling greater lethality, survivability, reach, situational awareness and adaptability than uncrewed systems can achieve alone."

In parallel with these situational awareness enhancements, the US Army is in the process of fitting the aircraft with the AGM-179 Joint-Air-to-Ground-Missile (JAGM), in addition to the Israeli-developed Rafael Spike NLOS (Non Line Of Sight) anti-tank missiles already fitted to its Apaches.

In the meantime, the Hellfire has been adapted to enable it to engage drone swarms, something that could be done by the 70mm Hydra 70 rocket as well. This munition has been developed from its initial unguided form to a precision weapon in the form of the Advanced Precision Kill Weapon System (APKWS), where the rocket guides itself on the final trajectory using a laser. Such is the accuracy of this system that USAF F-16s have used it to neutralise Houthi UAVs over Yemen, potentially creating another role for the Apache.

The British Army has ordered both the JAGM (instead of an indigenous variant of the Brimstone missile) and APKWS for its AH-64Es with others likely to follow.

Evolution has been a trend throughout the Apache's lifetime as Murrell says: "Ongoing modernisation efforts are demonstrating the combat-proven Apache's ability to absorb the newest capabilities, while paving the way forward for rapid and seamless capability integration through an open systems approach – enabling it to remain a dominant element of defence forces." However, could modern developments be the Apache's undoing?

The future of the attack helicopter

Throughout the war in Ukraine, videos have emerged of low-flying helicopters from both sides being shot down, raising the possibility that rotorcraft may now be too slow and vulnerable for future peer-on-peer conflicts.

With this concern in mind, the US Army has taken steps, including the cancellation of the FARA scout helicopter, instead using uncrewed systems in the aerial scout role – a move that Japan has also followed. Meanwhile, Bell's faster, higher-flying V-280 Valor tiltrotor was selected for its flagship Future Long-Range Assault Aircraft (FLRAA) programme.

◤ In 2013, Prince Harry (Captain Wales as he was known in the Army Air Corps) took his place in the front seat of the Apache AH.1 for both the aircraft's solo flying display and its appearance in the MERT (Medical Emergency Response Team) demonstration at the RAF Cosford Air Show.

▼ The prototype AH-64 flew 50 years ago. Unlike production variants, it had a prominent 'T' tail.

Boeing

Crown Copyright

Stephen Bridgewater/RAeS

▲▲ British Army WAH-64 Apaches were modified to operate from helicopter carriers and did so from HMS *Ocean* in 2011 during operations over Libya.

▲ The AN/APG-78 Longbow fire-control radar is housed in a bulbous unit over the rotor hub assembly. This allows the Apache to hover behind cover scanning for targets, with only the radar unit exposed. It can also monitor local air traffic or be used for surveillance and terrain profiling.

Now named the MV-75, this aircraft, which is designed for long-range operations in the Asia-Pacific region, leaves questions regarding how the Apache will fit the future force structure.

In the 1990s, the US Army banked on the Boeing-Sikorsky RAH-66 Commanche low-observable helicopter to scout ahead and find targets for the Apache. As costs grew and the RAH-66 was cancelled in 2004, this mission transferred to legacy designs, such as the OH-58D Kiowa which itself has subsequently been retired, shifting the reconnaissance role onto the Apache. Accordingly, there have been questions about whether a large attack helicopter, such as the Apache, is the right platform for reconnaissance missions in high-intensity conflict.

In October 2022, Boeing unveiled what it called the 'modernised Apache,' complete with a range of enhancements, including what appeared to be a new radar, full colour screen crew stations and engines designed to reduce their heat signature. Potentially, the most significant addition, however, is the ability to launch drones through canisters carried on extended stub wings. If these air-launched effectors could be deployed and controlled from a safe distance, this new concept of operations could allow the Apache to continue prosecuting targets with long-range missiles – of which the aircraft is shown carrying up to 16 – from beyond the range of anti-access, area-denial systems. The aircraft is also depicted with what could be a directed laser weapon mounted on the expanded pylon for protecting against small UAV threats. Meanwhile, only last month the British Army started searching for an autonomous collaborative platform to accompany its Echo models and carry out roles such as reconnaissance, target acquisition and defeating countermeasures. Plans for this VTOL device with a proposed payload of around 200kg is another case of the Apache becoming part of a 'system of systems.'

Exporting the Echo

Although earlier Boeing concepts for evolving the Apache – including a retractable landing gear and compound tail rotor – seem to have been discarded, the type's continued adaptability is proven by the number of countries that continue to order it.

The AH-64E model has been purchased by countries, such as Poland, which if it receives all 96 on order will become the second largest operator after the US.

Having originally operated the rival Eurocopter Tiger, Australia decided that the type no longer met its requirements so ordered 29 AH-64Es in 2021 instead.

Boeing has so far delivered more than 800 Apache 'Echoes,' including 50 to the UK and others to India, Indonesia, Morocco, the Netherlands, Qatar, Saudi Arabia, South Korea, Taiwan and the UAE.

According to Murrell, current upgrades will see software reducing workload. "These upgrades will allow the system to be more intuitive, allowing the crew to work with greater efficiency and maximise the effectiveness of new capabilities, like launched effects to maintain dominance on the battlefield."

Now entering its sixth decade, the Apache is continuing to prove its worth to customers around the world, facing a wide range of threats all over the globe. According to Boeing, there is currently enough demand for Apache production to run until 2028 and the aircraft has a roadmap to remain relevant and in service until the 2060s. While it continues to face the threat of evolving technologies that could make it obsolete, its sound design and ability to evolve, means the Apache demonstrates how an aircraft can continue to remain relevant over many decades.

Militarised murmurations

Can we take inspiration from startled starlings to create a murmuration of AI-enabled swarming drones? DR **DAVE SLOGGETT** thinks we have a lot to learn from bird brains.

Helsing

> THERE IS A DANGER THAT MILITARY PLANNERS ARE LOOKING, ONCE AGAIN, AT WHAT IS OFTEN REFERRED TO AS THE LAST WAR

Innovation In Contact (IIC) is central to contemporary military operations and, in the 21st Century, wars are increasingly likely to be fought in ways that are divergent from doctrine. The adage that the enemy gets a vote applies, especially when a conflict pits a numerically stronger adversary against one that is weaker in numbers. In such a situation those who can rapidly create novel ways of exploiting technology can rebalance their apparent disadvantage.

The Russian-Ukraine War is an example of such asymmetry. On paper, Russia has the strategic depth and the resources that, once fully mobilised, should see it be able to force its will on Ukraine, subjugating its people. However, this rather simplistic view of Russia's dominance has been shredded as the Ukrainians have created new ways of conducting military operations. These have been conducted at scale, and made the Russian military machine look sluggish, conventional (in a Cold War sense) and mired in historical approaches to warfare.

Conversely, Ukrainians have shown, with help from Western allies, that creativity and flexibility can hold the line. Arguably their greatest innovation has come in the rapid ways in which drone technologies have evolved to help counter any movement of land-based military formations to a wider range of tasks projecting military power over vast ranges.

Operation Spiderweb

As a result, a new warfighting adage has emerged from this war. If you can be seen, you will be engaged and likely destroyed. Rusting hulks of Russian tanks and infantry vehicles litter the battlefields of Ukraine as testimony to this perspective.

Perhaps the most extreme example of this has been the spectacular success the Ukrainians enjoyed launching Operation Spiderweb on 1 June, 2025. This operation, years in the planning, saw Ukraine transport more than 100 drones (in container lorries) to launching points deep inside Russia and within a few kilometres of major strategic airbases, from which the destruction of a number of Russian bombers and other key strategic aviation assets was successfully conducted.

Reporting on the raid, however, suffered from a single significant drawback – the use of the term 'drone swarms.' In Hollywood, and the minds of fiction writers, drone swarms are now a routine part of military operations but the reality is far from this state of affairs and many people have little appreciation of the technical issues underlying the creation and operation of swarms of drones.

Exploiting Western supplied satellite communications and some Russian mobile networks, the Ukrainians were able to deploy live command and control links to human operators, based in Ukraine, who were able to fly the drones using First Person View (FPV) technologies. Subsequent imagery showing the success of the attacks proved how this worked and provided a powerful narrative of the outcomes of the operation – restricting Russia's inevitable denials.

However, for all of its impressive achievements, this mission was not what some in the media portrayed. This was not a 'drone swarm' in the true sense of a number of platforms working together, autonomously, to achieve a goal. This was a number of drone operators flying drones from their launch points to the targets. This was a serial attack and each drone was accurately placed on a target airframe, close to fuel tanks, increasing the probability that the aircraft would be destroyed.

Russia's somewhat complacent view that its strategic aviation had been withdrawn out of range of any Ukrainian mission meant the attackers had time to conduct such precision flying. Clearly, no Russian counter-drone capabilities were expected to be operating.

Tactically, having unmasked such an attack vector, it is to be expected that Russia will now be urgently trying to equip its strategic airbases with some form of counter-drone capabilities, likely resorting to the deployment of electronic warfare (EW) capabilities to jam satellite navigation and communications systems as its immediate response.

Closer to home

Much though the Western press has enjoyed the strategic setback that Ukraine inflicted on its enemy, such a mission raises serious issues for NATO air forces concerning how they might counter a similar Russian inspired attack. Could Russia do the same to NATO and, more specifically, UK airfields?

The attack on Airbus A330MRTT Voyager aircraft at RAF Brize Norton on 20 June proved that British airfields are vulnerable in even greater ways than their Russian equivalents and shows the scale of the problems faced today in securing airfield perimeters from physical incursion, let alone infiltration by drones.

Now imagine a scenario where Russia used its so-called 'grey fleet' of ships to bring containers full of drones into the North Sea and position them to attack UK airfields in a prelude to conflict. Keeping track of these ships is clearly a priority for UK defence, especially as they can also be engaged in operations designed to damage undersea cables. Recently the Russians have started to escort these ships with naval vessels, lowering the threshold of conflict if the actions of the vessels appear hostile, complicating their interdiction.

Justifier Drone

Security Service of Ukraine

While such discussions are helpful in trying to imagine new threat vectors, there is a danger that military planners are looking, once again, at what is often referred to as the last war. As new vectors are imagined, so planners must anticipate how they can be countered. IIC has an associated time delay and is reactive. Being ready for a new threat helps reduce its effectiveness as soon as it is deployed.

Autonomy vs swarming

To some extent the Ukrainians are already forging this path at scale and at tempo – two vital qualities of IIC. The latest generations of their front-line combat drones have a capability to detect, classify and identify targets in trenches or out on open terrain using AI-based algorithms.

While this raises moral questions about the delegation of the authority to engage targets to algorithms in high-density front-line environments, this is not quite the problem some might imagine. With accurate demarcation of boundaries where friendly forces are operating, it is possible to reduce, but not eliminate, the potential for blue-on-blue engagements.

Giving some degree of autonomy to an individual drone is one thing – the real challenge comes in enabling a swarm to operate collectively to achieve any one of a number of mission profiles – in effect developing a collective consciousness. Solving this problem is the key next step in the evolution of drone technologies.

Murmuration

The question for aerospace engineers is how to create an ability for each drone in a swarm to collaborate with its nearest neighbours.

One of the prevailing zeitgeists in military thinking is to look to nature for inspiration for how to solve complex problems. Examples of such biomimicry already exist and, when it comes to creating drone swarms, it is possible to suggest that we do not need to look much further than murmurations of starlings as a case study.

A murmuration is an incredible sight. Set against the evening sky hundreds, if not thousands, of birds appear to fly in a tight-knit formation, almost moving as one in three dimensions. Within the mass expanse of the murmuration there can often appear to be substructures slightly disconnected from the main formation. Outliers also appear as individual starlings become detached from the formation as it manoeuvres rapidly.

Scientific studies of the creation of these formations date back many years. In the early 20th Century, British ornithologist, Edmund Selous (1857-1934) opined that the behaviour occurred because of a direct transference of thoughts among animals, a form of telepathy. He noted at the time that "they must all think collectively, all at the same time."

Recent analysis has moved on from this, to acknowledge what is known as the 'startle reaction,' often created by the presence of a predator in the immediate vicinity. Current thinking suggests that the murmuration is a collective effort by the starlings to create a formation that makes it hard for a predator to isolate a specific bird for predation. The cluster is a self-defence mechanism and schools of fish exhibit similar tactics when faced with larger predators. At the heart of this is the desire to survive.

Bird brains

In trying to exploit this behaviour, aerospace engineers can draw on research conducted by biologists that shows how bird brains are neurologically structured. Some species of birds have long been known to have exceptional levels of intelligence and problem-solving abilities. These birds, of which starlings are a good example, have areas of their brain where the density of neurons

> THIS RAISES THE IDEA THAT DRONES MIGHT BECOME DRONE KILLERS OPERATING IN A SWARM, SELF-SELECTING TARGETS FOR ENGAGEMENT

▼ Anduril's Roadrunner is a reusable VTOL autonomous air vehicle designed for high-subsonic speeds and extreme manoeuvrability. It can be used for various missions, including as an interceptor against drones and other aerial threats.

▲ Left to right:

Ukrainian company Justifier Drones has created an FPV interceptor drone that is launched from a carrier drone to increase the range and altitude of interceptions.

FPV drones in containers destined for Operation Spiderweb.

A Ukrainian drone strikes a Russian bomber during the audacious Operation Spiderweb attack.

A Russian ZALA 421-16E reconnaissance drone moments before being downed in August 2024.

exceeds that of many mammals. This is thought to be where a collective instinct for survival originates. Individual birds use their eyes to allow them to fly very close to their neighbours and to sense when they should manoeuvre. Manoeuvres by the entire murmuration also highlight how starlings' rate of turn is faster than their predators, further increasing their survival chances.

This collective movement provides an inspiration for autonomous drones but it is important to clearly define an objective which creates the harmonised response. In this case the solution moves from survival to destruction of the threats from the enemy. Depending on the mission objectives, similar harmonisation can be achieved across a range of military applications, such as in the air defence domain where a wide range of effects can be delivered depending upon the attack vector selected.

Take, for example, the problem of Russian glide bombs. These are launched from aircraft well away from the missile engagement zone of air defence systems, and their trajectory and size make them hard to detect and track, enabling a successful engagement to occur. Their potential weakness is that they rely on access to satellite navigation signals, which can be jammed. EW is, therefore, a valid means of lowering the accuracy with which glide bombs can engage targets.

Drones on combat air patrol

It is possible to envisage an EW-equipped drone swarm operating the equivalent of a Combat Air Patrol (CAP), deploying sensors capable of sensing the threat from the glide bombs and then tasking elements of the CAP to move and deliver an EW barrage against the threat jamming the satellite signals along the threat axis. Once the threat has been disrupted, the drones return to their CAP holding positions.

Similar ideas of a deployable CAP based on drones can be applied to the need to counter the increasing threat from unintelligent drones launched by Russia at Ukraine every day. It is likely this launch rate will soon pass 2,000 per day with production facilities being ramped up in both Russia and China. Building cheap decoy drones is going to create an even harder problem for the hard-pressed Ukrainian air defence systems in the immediate future. Cheap drones that are able to collectively detect, track and engage such threats are clearly a solution worthy of consideration.

This raises the idea that drones might become drone killers operating in a swarm, self-selecting targets for engagement. A flight model of such a concept has already been demonstrated in the UK with a drone armed with lightweight air-to-air missiles. Enabling such a drone to operate in a swarm, deploying off CAP, to meet a threat detected by radar and working in concert with EW equipped drones, creates the basis of a highly flexible and fluid air defence system. Furthermore, it balances the minds of technologies that are required to deal with the ballistic and cruise missile threats alongside the cheap drone and decoy threats that are often blended into each attack, trying to explore where the Ukrainian air defences are at their weakest.

Summary

Such a concept is an obvious innovation that seeks to give the hard-pressed air defence systems an ability to match what is an expanding threat vector, forcing Russia to invest and develop in even higher drone production. While this does not break the impasse that exists in the war, through IIC and being ahead of the obvious threat dynamics enables Ukraine to hold the line. This, against a numerically superior adversary, is impressive in its own right and buys time for the economic sanctions being increasingly applied by the West against Russia to intensify its strangulation of the Russian economy.

Rolls-Royce

Air power faces the *'Next Storm Rising'*

Taking place earlier this summer, the RAF Chief of the Air Staff's Air and Space Power Conference saw air and space leaders from across the globe gather in London. **TIM ROBINSON** FRAeS reports.

In July, some 66 air and space chiefs from around the world gathered in London for the RAF's Chief of the Air Staff Global Air and Space Chiefs' Conference (GASCC). Organised by the UK-based Air and Space Power Association (ASPA), this event has grown in stature and importance in recent years to become an essential part of the global aviation calendar for air power professionals, industry, academic and media.

This year, with seismic changes in geopolitics that put the 70+ year old international rules-based system under threat, a recent UK defence review, conflicts in Ukraine, Kashmir and the Middle East, the militarisation of space and the rapid acceleration of technology, such as drones and AI, that poses fundamental questions on the nature of conflict – there was no shortage of topics or themes for the delegates to ponder.

Speakers ranged from air chiefs from services, including the USAF, Royal Australian Air Force (RAAF), German Luftwaffe, Royal Netherlands Air Force, and Italian Air Force to academics and industry executives from firms, such as BAE Systems, Northrop Grumman, Lockheed Martin and Leonardo. Combined, they provided a broad and diverse range of global viewpoints that spanned the current strategic context, space operations, air power lessons from current conflicts and the future of autonomous weapon systems. Sessions included 'Setting the Global Stage', 'Establishing Control and Building Resilience', 'Autonomy and 6th Generation Air Power', 'Countering Emerging Threats' and 'Identifying the Correct Lessons from Today's Conflicts'. The two days of debate allowed for frank discussion and lively Q&A sessions from approximately 500 delegates.

▲ A GCAP prototype is expected to fly in 2030, it was revealed at the conference.

▼ Outgoing RAF Chief of the Air Staff ACM Sir Richard Knighton addresses the audience.

Tim Robinson/RAeS

Off the record

However, while the panels included senior RAF and military chiefs, new press rules from the UK government ensured much was considered off the

Air and Space Power Association

record and not for reporting – a factor to bear in mind when reading reports from this conference.

Pressed on this at an 'on-the record' Q&A following his keynote with the question: "At a time when the general public needs to fully understand the threats we face, why is the government gagging our military leaders?" Parliamentary Under-Secretary of State for the Armed Forces, Luke Pollard MP answered: "There's still a challenge, I think, about how we define some of the classification of our comments that we want to get after, because I really do want to see our military personnel be able to tell the story."

However, he noted: "as much as I would like to think that I'm a trusted communicator, I'm also a self-aware politician that knows people don't often trust people in suits but, by word, they trust someone in uniform. I think we've got a journey to go on there to build that confidence."

With those reporting restrictions in mind, it means more than 30 speakers could not be reported, so this article will just be a snapshot of some of the presentations. Let's take a look at some of the highlights from the conference.

CAS warns of 'Next Storm Rising'

The conference was also notable in that it was the final GASCC for the current Chief of the Air Staff, ACM Sir Richard Knighton – the first ever non-pilot to lead the Royal Air Force in the service's 107-year history. After this successful tenure – Knighton is now moving on to the top UK defence job as Chief of the Defence Staff (CDS). Replacing him is Ulsterman, ex Harrier pilot and former Space Command Chief AM Harv Smyth – a popular leader who took over at the end of August. Having an RAF CDS (and a skilled political operator) in the form of Knighton, helps place air and space power at the heart of the UK's post-*Strategic Defence Review* (SDR) plans and ensure that the RAF's voice is heard at the highest levels – particularly in the autumn when it is expected that budgets will reveal how much of the SDR's ambition is affordable.

▲ The conference saw 66 air and space chiefs from around the globe assemble in London.

> "I AM CLEAR, AND THE SDR IS CLEAR, THAT WE CANNOT WIN - OR EVEN DETER - ON OUR OWN. THIS IS A TEAM GAME. OUR ALLIES AND PARTNERS ARE VITAL
>
> **ACM Sir Richard Knighton**
>
> Chief of Staff, Royal Air Force

Giving his last ever keynote as CAS, ACM Knighton used his 'on-the record' speech to highlight the UK's vision for future air power and the RAF, as set forth in the recent SDR. He noted that the SDR represents "a radical shift for the UK" and "provides a clear focus on warfighting readiness, being NATO first, and using defence as an engine for growth, with UK innovation driven by lessons from Ukraine, and a whole of society approach." Knighton pointed out speaking to RAF officer cadets recently that: "they are entering an air force that none of us have known in our careers. With budgets rising, and numbers growing." This defence boost in spending was a "watershed moment."

However, this was being clearly driven by increased threats with Knighton warning: "we need to be ready quickly." Calling on his fellow chiefs in the room. he added: "I am clear, and the SDR is clear, that we cannot win – or even deter – on our own. This is a team game. Our allies and partners are vital."

Referencing the classic 1980s' Cold War techno-thriller, *Red Storm Rising* from Tom Clancy, Knighton highlighted the challenges and opportunities of integrated multidomain operations – and how the West needs to be ready for the 'Next Storm Rising', as Russia licks its wounds and rebuilds its military. Said Knighton: "Over three years and a million casualties later, the Russians might be slow learners – but they are definitely learning. The Russian forces of today are different to those of 2022."

Helsing

▲ Test pilots evaluating Helsing's Centaur AI system.

He noted: "Ukraine is a 19th Century war, fought with 20th Century tactics and 21st Century weapons," adding: "To avoid those killing fields, we must prepare for 21st Century warfare with 21st Century capabilities and 21st Century thinking. This is going to require effective and dynamic integration across all five domains."

GCAP prototype to fly by 2030

In another keynote, Defence Minister, Luke Pollard MP noted how, at the 2024 GASCC, his refusal to pre-empt the SDR on ring-fencing GCAP had generated many questions. However, this year with SDR now published, he said: "A year later, I'm absolutely proud to stand on the same stage and say that GCAP is progressing well," adding: "It already supports 3,500 UK jobs and 1,000 apprenticeships and, last week, we cut the ribbon at GCAP's new headquarters in Reading where hundreds of skilled personnel will be based."

Also on GCAP, Lt Gen Antonio Conserva, Chief of Staff, Italian Air Force revealed that a prototype for the tri-national future combat aircraft is expected to fly by 2030, ahead of service entry five years later. This is a separate effort from the UK's own Flying Combat Air Demonstrator – which will be ready to fly by the end of 2027. (See 'Blueprint', *AEROSPACE*, August 2025).

From interoperability to 'interchangeability'

Meanwhile, in his presentation, US Chief of Staff of the Air Force, Gen David Allvin used the analogy of the classic board game, 'Risk' to explain how it was getting harder and harder for the US to 'pre-position pieces on the board.' This, he explained, was thanks to expanding anti-access/area denial areas, longer ranged weapons and restrictions on overseas basing and support, saying: "We can't put our pieces on the board exactly where we'd like to." Taken to extremes, he said: "If we continue to be an air force that is just going to go from the outside in, we're going to be fighting off the coast of California, and that doesn't do anyone any good because you need speed and tempo. You cannot generate the tempo to have the effects that you want from that range."

> "IF WE CONTINUE TO BE AN AIR FORCE THAT IS JUST GOING TO GO FROM THE OUTSIDE IN, WE'RE GOING TO BE FIGHTING OFF THE COAST OF CALIFORNIA
>
> **Gen David Allvin**
> US Chief of Staff of the Air Force

Allvin opined that the solution was, therefore, to work more closely and deeper with partner air forces within these contested environments to generate that speed and tempo using 'co-use', 'co-development' and 'co-production'.

This, he said, could include 'interchangeability,' where partner nations not only join larger force packages, but individual aircraft could join other air forces' flights or pilots could fly other nations' aircraft – particularly the ubiquitous F-35. Indeed, a glimpse of this was seen at July's Exercise Talisman Sabre where two USAF pilots flew RAAF F-35As – an achievement that was made possible because even minor differences between nations' F-35s have been stripped away to give a truly interchangeable combat aircraft without any type conversion needed. Long experience in shared training exercises, standards and doctrine do the rest. Sharing parts, pilots, weapons and refuelling then with 'interchangeability' is a vision of how air power can build deeper and stronger alliances and become more than the sum of its parts.

Concluding, Allvin said: "This is the opportunity we have to be collectively lethal. So once again, the sum of the parts is so much greater. This is the value proposition of the speed and tempo that can be generated by air forces, not an air force."

However, as one panellist noted in a separate session, some of these basics, taken for granted during the Cold War – such as being able to conduct no-notice landaways around Europe and being refuelled by allied nations – will need rediscovering and putting back in place.

Next Storm Rising
ACM Sir Rich Knighton
THE AIR & SPACE POWER ASSOCIATION
THE CHIEF OF THE AIR STAFF'S GLOBAL AIR & SPACE CHIEFS' CONFERENCE 2025
Tim Robinson/RAeS

Lessons from recent conflicts

As might be expected, the two-day conference saw much discussion on the air and space power lessons from the ongoing war in Ukraine, Israel's 12-day air campaign against Iran, USAF's Operation Midnight Hammer and the Indian-Pakistan aerial clash over Kashmir in May 2025.

As well as more recent conflicts, the head of the RAAF, Air Marshal Stephen Chappell, provided a vignette from 84 years ago, when Lockheed Hudsons from 1 Sqn scrambled to repel a Japanese invasion fleet off Malaya an hour before the attack on US forces at Pearl Harbor. Launching with ships on the horizon, Chappell noted how the entire take-off, attack and landing, had lasted the time it took one of pilots to smoke a single cigarette – such was the sudden speed in which peace had turned to war.

Meanwhile, Deputy Commander NATO Air Command, Air Marshal Sir Johnny Stringer, noted that "what we saw over Iran recently is how you really can't conceive of air superiority, counter, counter AA/AD and integrated air and missile defence without seeing how all of them actually join up."

However, Stringer argued that, as well as fixing procurement and acquisition, "we also need to think a little bit more imaginatively. For example, air defence picket drones" to fill in the glaring holes in integrated air and missile defence.

Preparing for the AI singularity

Another session, which covered AI and autonomous systems, saw Prof Kenneth Payne, Professor of Strategy, King's College London, explaining that he had "detected something of a tectonic plate shift around this issue" among military professionals discussing AI. He explained that "until fairly recently, you would not be laughed at, because everybody's too polite, but you would be treated with a degree of scepticism when talking about super intelligence."

▲ ACM Knighton warned that air and space forces need to be ready for the Next Storm Rising.

> BY 2040, WHEN FCAS OR TEMPEST IS DUE TO ENTER SERVICE, I SUGGEST SIXTH-GENERATION AIR POWER WILL BE UNCREWED. THERE'LL BE NO HUMAN IN THE LOOP, ON THE LOOP OR BEFORE THE LOOP
>
> **Dr Keith Dear** CEO and Founder, Cassi

This attitude is shifting fast, he explained. However challenges remain. He noted that, particularly when the idea of 'ethical AI' is considered, observing that there is no one single human set of ethics means "we don't have a single consistent ethical framework that you can upload [to] the computer and say, 'now, please go out and do it.'"

Meanwhile, Dr Keith Dear, CEO and Founder, Cassi, issued a stark warning about the staggering pace of AI developments – which is consistently arriving faster than predicted. He argued that air forces need to embrace it, lest they become swiftly obsolete and lose the next war. He said: "By 2040, when FCAS or Tempest is due to enter service, I suggest sixth-generation air power will be uncrewed. There'll be no human in the loop, on the loop or before the loop."

He added: "What will differentiate and determine victory in the future will be the effectiveness and the efficiency of your automated innovation system, a world where atoms move as fast as bits, where we're constantly connecting front lines to factory to generate new capabilities on a daily basis, if not faster, in order to keep up with the threat as it changes in front of us."

Dear argued that air power need not wait until 2040 for some of these capabilities. "Layered, narrow AI would get you there already," he said. "We already know that controlling large numbers of capabilities is something that AI does better than humans."

He also made the point that these AI advances in speed, decision-making and solving complex tasks are now accelerating. He recalled how a USAF fighter pilot, bested by AI in the DARPA Alpha Dogfight trials (conducted in a simulator in 2020), had been asked when he expected this technology to make it into the cockpit. They had estimated it would be at least ten years and possibly two decades – but in fact, Dear said, just four years later the US Secretary of Defense had flown in the VISTA F-16 with BFM performed by AI.

USAF

Given these advances, he said the median estimate for Artificial General Intelligence (AGI), "an AI that outperforms humans, not only in all cognitive tasks, but also the things that, historically, humans have found easy and machines have found hard," is only four years away in 2029.

Yet, if this vision is even partly correct, these advances in AI raise fundamental questions, not just for air power professionals and warfighters but for human civilisation as a whole. This was a point raised by one air force chief in the Q&A, who mused: "I couldn't help but think of the Fermi Paradox and the Great Filter – and what becomes more compelling is the humanity piece of the species," and how human civilisation ensures it is on a 'positive vector' with AI – rather than sowing the seeds of its own demise.

A glimpse of future air combat

Some evidence of the impact that AI will have on air combat came on the sidelines of GASCC at a hotel next door, where European start-up, Helsing had set up two flight simulators to demonstrate its Centaur AI software, which had previously been tested using a Saab Gripen E.

For this demonstration, two veteran 'human' fighter pilots, flying simulated F-16s attempted to take on two F-16s powered by the Centaur AI in a BVR 2 v 2 battle. Over the course of multiple engagements and by using machine learning, the AI F-16 'learnt' the rules of BVR combat with tactics, such as cranking and going cold, emerging organically and challenging these highly experienced fighter pilots to the limit.

While this scenario was artificially limited (no countermeasures were allowed), it is easy to see how this software, incorporated into future collaborative combat aircraft (CCAs) could provide human pilots with lethal drone wingman.

▲ Are air forces ready for the AGI and the singularity?

> "YOU ARE NOT SIMPLY EMPLOYING THE WEAPON. YOU ARE, IN A SENSE, BECOMING THE WEAPON. YOUR VIEW IS THE WEAPON'S VIEW
>
> **Dr Jacob Parakilas**
> Research Leader, Defence, Security & Justice, RAND Europe

Elsewhere, Dr Jacob Parakilas, Research Leader, Defence, Security & Justice, RAND Europe, raised some interesting questions over the psychological challenges of the use of CCAs and drones in future autonomous aerial warfare. In particular, for first-person view (FPV) drones, he noted: "You are not simply employing the weapon. You are, in a sense, becoming the weapon. Your view is the weapon's view. You are driving it directly into the target, which may be an enemy, and you may be hitting a person directly." That and the 'gamification' of war where the public can now bypass filters to see combat footage directly online, cheer their side on in online forums, or crowdfund the purchase of drones, is also novel.

Summary

With two days of high-level presentations that covered everything from interoperability, UK SDR, Operation Spiderweb and even existential questions about the future of humanity – GASCC has cemented its position as one of the premier air power forums for debate and discussion. Moreover, its impact is being felt in the wider world, beyond industry, academia and air power professionals, with ACM Knighton paying a personal tribute to ASPA President, Greg Bagwell for his unrelenting effort in helping to communicate the critical importance and role of air and space power to the public, press and politicians when it is more critical than ever to get its message across.

Advertorial

Visitor registration now open for **Advanced Engineering 2025**

Powering the possible – composites spotlight and SME innovation take centre stage

Visitor registration is now open for Advanced Engineering UK, the UK's leading annual gathering of engineering and manufacturing professionals. Taking place on 29 & 30 October 2025 at the NEC Birmingham, Advanced Engineering is the UK's only event that connects the entire industrial ecosystem, now featuring exciting new additions like the expanded Composites Pavilion, the SME Village, the ADS Pavilion, AM2 Forum (Additive Manufacturing and Advanced Materials Forum) and a focused Electronics Zone. Together, these zones provide fresh opportunities for innovation, collaboration and growth — all designed to power the possible.

A highlight for 2025 is the newly expanded Composites Pavilion, now in its fourth year and fully booked well in advance. Delivered in partnership with Composites UK, the pavilion offers smaller companies and SMEs turnkey exhibition pods – complete with branded displays, video screens and shelving – making it easy and cost-effective to showcase their innovations. Next to the Composites Networking Zone, the pavilion provides high visibility and attracts key OEM visitors.

Alongsie the pavilion, the Composites Networking Zone will feature hands-on demos from PRF Composite Materials, showcasing prepreg systems, including rapid processing RP570 presses and innovative recycled carbon solutions. Insights from end users across aerospace, automotive, marine and renewables will highlight how composites are driving high-performance applications and net-zero ambitions across sectors.

Composites UK has reimagined the Composites Forum for 2025, curating two full days of expert-led sessions focused on sustainability, material circularity and new product development – all aimed at strengthening the sector's innovation and collaboration. Here, the Composites Networking Zone will be a key feature, with PRF Composite Materials hosting interactive demos and networking sessions designed to foster valuable industry connections.

The event will also reinforce the role of SMEs and agile innovators through dedicated spaces such as the SME Village, platforming disruptive technologies across automation, embedded systems, semiconductors and more. These zones underscore the crucial role SMEs play in driving innovation and growth across the UK's engineering and manufacturing sectors.

"Advanced Engineering is the only UK event that connects every corner of the industrial ecosystem," said Simon Farnfield, Event Director of Advanced Engineering at Easyfairs UK & Global. "With zones focused on composites, electronics and SME innovation, and forums designed to address the industry's biggest challenges, the 2025 edition is set to deliver even more value for visitors and exhibitors alike. This edition will feature over 400 exhibitors, including more than 130 making their debut, meaning that a lot of the stands will offer something brand new to discover."

Over 200 expert speakers are also set to take stage across multiple forums to explore key topics including digitalisation, supply chain resilience, sustainability and government policy. The event will also continue its #MINDTHEskillsGAP initiative – launched to help tackle the UK's ongoing shortage of engineering and manufacturing talent.

Advanced Engineering is co-located with Lab Innovations, with attendees receiving a single badge granting access to both events. With free visitor registration now live, early registrants will receive exclusive updates on speakers, exhibitors and feature areas, so register today at: **https://www.advancedengineeringuk.com**

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Rent don't buy: inside the economics of aircraft leasing

Airbus

Boeing

With the aircraft leasing market going from strength to strength, **JOYCE ABAÑO** asks why airlines are increasingly renting instead of buying.

Leasing now powers over 50%[1] of the global commercial aircraft fleet, marking a major shift in how airlines manage their assets as they increasingly prioritise financial flexibility and balance sheet efficiency.

In a market where a new aircraft can cost between $50m and $500m[2], and deliveries from OEMs are often delayed by months, if not years, leasing offers a faster, more flexible way to add capacity.

Whether it is a long-term lease to support expansion plans, a short-term aircraft, crew, maintenance and insurance (ACMI) contract or a wet lease to meet seasonal demand, leasing allows airlines to modernise fleets, test new markets and preserve cashflow without locking up capital or taking on major debt. This model is especially appealing in today's high-interest, high-demand environment, where speed, adaptability and financial agility are everything.

In the mid-2000s, aircraft lessors started being seen as deeply involved in shaping aircraft programmes as they purchased aircraft in large quantities and leased them to airlines globally. By 2030, the global commercial aircraft leasing market is projected to grow significantly, reaching an estimated value of $325bn, reflecting a compound annual growth rate of 7.9% between 2024 and 2030.[3]

Far from being a stroke of luck, this continued growth did not just happen by chance. It emerged from the very challenges that almost threatened to dismantle the industry.

Crises accelerated a strategic shift

The commercial aircraft leasing industry has faced unprecedented disruption from two major global

events in recent years: the global pandemic and the ongoing Russia-Ukraine conflict.

The pandemic triggered a dramatic collapse in global air travel, with lockdowns and border closures forcing airlines to ground most of their fleets. As passenger demand plummeted, airlines saw steep revenue losses and responded by slashing operational costs, including returning leased aircraft or renegotiating contracts with aircraft manufacturers.

This led to a surplus of airliners available for lease, which in turn drove lease rates down sharply across the industry. The imbalance between supply and demand underscored the leasing sector's vulnerability to sudden shocks. Russia's 2022 invasion of Ukraine brought additional upheaval. As international sanctions came into force, Western lessors were forced to terminate lease agreements with Russian airlines, amounting to nearly the entire Russian leased fleet. EU and US bans also restricted the sale of aircraft and components to Russia. In retaliation, Russia began nationalising foreign-owned aircraft, investing in domestic aircraft production and pivoting toward domestic aviation routes to fill the void left by international carriers.

Together, these events exposed both the resilience and fragility of the aircraft leasing model, highlighting the need for more adaptive risk management, geographic diversification and closer scrutiny of political and economic risks.

As global travel restrictions eased in 2022 and 2023, passenger traffic rebounded sharply, especially in domestic and regional markets. Airlines rushed to scale up operations but faced long delivery backlogs from aircraft manufacturers. Boeing and Airbus struggled to ramp up production post-pandemic due to supply chain issues and labour shortages. This made leasing the fastest way to boost capacity.

With demand rising and supply constrained, lease rates began to climb, reversing the deep discounts of the pandemic. Aircraft values also began to recover, especially for narrowbodies, like the A320neo and 737 MAX, restoring lessor profitability. Amid high interest rates and tight balance sheets, airlines increasingly preferred operating leases over ownership to conserve capital. This financial strategy favoured lessors, as leasing provided more predictable cashflow and flexibility.

"Higher interest rates make leasing more attractive by reducing the need for upfront capital," explained Valo Aviation CEO, Hanna Hakamo. "Broader global and market-related uncertainties, in turn, increase demand for shorter, more flexible lease terms that allow operators to remain adaptable without long-term commitments."

Increase in tourism and demand in emerging markets

Ireland, the birthplace of aircraft leasing, remains a global hub with decades of industry leadership. However, countries, like the UAE, particularly Dubai, are now emerging as strong competitors, aiming to establish themselves as new centres for aviation leasing.

In Ireland in the 1970s, Tony Ryan founded Guinness Peat Aviation (GPA), which later evolved into AerCap, now one of the world's largest aircraft lessors. This early start gave Ireland a decades-long head start in building expertise, infrastructure and talent in the sector. Ireland offers a low corporate tax rate of 12.5%, making it attractive for global leasing firms. It also has an extensive network of double taxation treaties with over 70 countries, which helps lessors avoid being taxed twice on the same income. Irish-based firms now manage over 60% of the world's leased aircraft, and more than 30 leasing companies operate from Dublin.

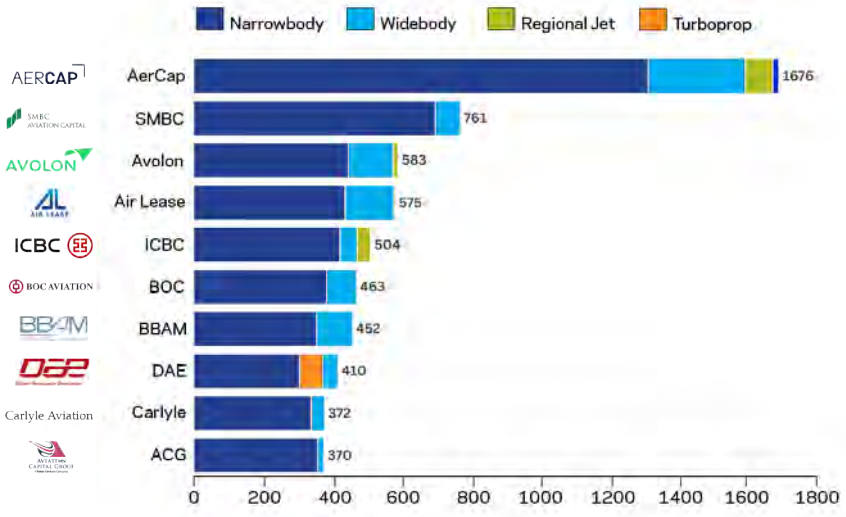
Some of the world's largest leasing companies are headquartered in Ireland, like AerCap, SMBC Aviation Capital and BohaiLeasing's Avolon.

The godfather of aircraft leasing

It was in Ireland that Steven Udvar-Házy began shaping the future of aircraft leasing. While studying aviation, he advised an Irish airline overloaded with too many aircraft types to help streamline its fleet – a move that proved so successful, the partnership lasted for years. Spending time in airports, Udvar-Házy quickly identified gaps in the market, spotting which aircraft needed selling and who needed to buy. By the age of 21, he had already brokered his first million-dollar aircraft deal, laying the groundwork for a career that would transform global aviation finance.

Udvar-Házy co-founded International Lease Finance Corporation (ILFC) in 1973, building it from a small start-up into one of the world's largest aircraft leasing companies over the following decades. In 1990, ILFC was sold in part to AIG, which completed full ownership in 1992, though Udvar-Házy remained as

The world's leading aircraft leasing companies



◀ Opposite page, clockwise from top left:

Bank of China's BOC Aviation leases airliners to more than 90 airlines in 48 countries, including Cathay Pacific, Qantas, Air France and Emirates.

During June's Paris Air Show 2025, Saudi Arabian lessor, AviLease announced an initial order for ten Airbus A350F freighters and 30 A320neo family aircraft. The agreement also foresees a future increase to 22 A350Fs and 55 A320neo aircraft.

Founded in 2010 by Dómhnal Slattery, Avolon focuses on narrowbodies and has over 400 single-aisle aircraft in its fleet.

AerCap acquired GE Capital Aviation Services (GECAS) in 2021 and is now the world's largest lessor, including the biggest fleet of both single-aisle and twin-aisle jets. It also boasts the largest fleet of leased regional jets in the world.

◀ Steven Udvar-Házy, the godfather of aircraft leasing.

Chairman and CEO. After leaving ILFC in early 2010, he founded a new venture, Air Lease Corporation, in February of that year, taking it public in April 2011.

Udvar-Házy, often called the 'godfather' of aircraft leasing, helped shape an industry that now finances about half the world's commercial aircraft. Known for his deep global airline ties and bold industry influence, he has swayed aircraft design decisions at both Airbus and Boeing – and is not afraid to publicly challenge their performance or strategies.

Udvar-Házy's criticism of Airbus' initial A350 proposal forced the manufacturer to go back to the drawing board, eventually leading to the A350 XWB (extra widebody), a much-improved aircraft that has since become a top-seller. Udvar-Házy, along with Air Lease CEO, John Plueger, was also among the first to sound the alarm on supply chain issues threatening aircraft production targets.

Global expansion

The surge in air travel demand across emerging regions, particularly the Middle East, India, Southeast Asia, and parts of Africa, has significantly fuelled the aircraft leasing industry's global expansion.

These fast-growing aviation markets are investing heavily in fleet modernisation, new carriers and route expansion – developments that increasingly rely on leasing models to meet demand without the heavy upfront costs of aircraft ownership. As a result, leasing is no longer centred solely in Europe and the US and is becoming an essential strategy for growth-oriented airlines across developing regions.

"An increase in tourism in the [Middle East] region will mean airlines need additional aircraft capacity to meet demand," Gediminas Žiemelis, chairman of Avia Solutions Group, said in an interview. "Consider Saudi Vision 2030, which aims to raise tourism's share of gross domestic product (GDP) from 3% to 10% and attract 150m annual visits. To meet these targets alone, it is clear that more aircraft will be needed."

> LEASING ALLOWS AIRLINES TO MODERNISE FLEETS, TEST NEW MARKETS, AND PRESERVE CASH FLOW WITHOUT LOCKING UP CAPITAL OR TAKING ON MAJOR DEBT

Žiemelis said that, while airlines always have the option to either own or long-term lease aircraft, smart airlines in the region will look to use ACMI providers that can offer short-term capacity solutions that do not burden them with balance sheet obligations when the aircraft is not being utilised optimally. "Our estimation is that when ACMI is used properly, airlines can see a 2% to 3% increase in their profits," Žiemelis explained.

Fleet expansion

Gulf carriers are aggressively expanding via leasing: Riyadh Air ordered Airbus A321s and leased its first Boeing 787-9 as a training aircraft, and aims to scale fast ahead of projected 2025 operations.

Saudia's fleet modernisation strategy similarly uses leased aircraft to match capacity with demand, shifting routes and aircraft types between Heathrow and Gatwick for optimised operations.

Across the Gulf, governments – including the Saudi sovereign wealth fund, the Public Investment Fund (PIF) – are incentivising leasing firms to establish regional operations, with hubs like Dubai South poised to rival Ireland as leasing centres.

In July 2025, global lessor, Avolon ordered 75 Airbus A321neos and 15 A330neos, as demand for leased aircraft continues to grow. This brings the company's total Airbus orders to 413.

Dublin-based Avolon, recognised as the world's second-largest aircraft lessor, also secured purchase rights for 25 more A321neos and options for 15 A330neos. CEO, Andy Cronin said demand is likely to exceed supply in the coming years.

Avolon expects to receive around 70 aircraft annually and has nearly placed all 40 of the A330neos that it has on order. The company also reported a 36% jump in Q2 net income following its $5bn acquisition of Castlelake Aviation.

Elsewhere, the Saudi PIF's AviLease placed its first direct order with Airbus in June 2025, signing a deal for 30 single-aisle jets and ten A350 freighters, with options that could raise the total to 77 aircraft.

Despite a booming aircraft leasing market, lessors face rising legal and geopolitical complexities that demand attention. This highlights how geopolitical tensions are fundamentally reshaping the aircraft leasing business model, introducing legal uncertainties around repossession rights, cross-border enforceability and insurance frameworks. One of the more notable examples is the estimated $4.7bn in aircraft that remain stranded in Russia following the 2022 sanctions. While a UK High Court ruling in June is generally positive for the aircraft leasing industry, it also comes with important caveats. The ruling confirms that losses, like those in Russia, are covered under 'war risk' insurance, rather than broader all-risk cover, reducing ambiguity in future claims. This obliges major insurers, like AIG, Lloyd's and Chubb

LogoSky

▲ UK start-up airline, Global Airlines, operated its first flight, from Glasgow to New York-JFK, on 15 May 2025, using an Airbus A380 under a damp lease contract with Hi Fly Malta. Following a mixed reception, rumours abounded that the airline plans to pivot to become exclusively an ACMI operator, but founder James Asquith has denied this.

to compensate lessors. AerCap alone is set to receive more than $1bn, adding to the billions already settled.

This sets a legal precedent that strengthens lessors' ability to secure compensation in similar geopolitical events. While this is helpful, it may lead to rising war-risk insurance premiums and tighter contract wording in future policies. Insurers are likely to reassess their exposure, potentially increasing costs for leasing companies.

Currently, insurance companies are already adapting to the rapid growth of aircraft leasing by reassessing risk models, expanding war risk coverage and developing specialised policies tailored for leasing firms.

Customisation introduced strain

When airlines customise interiors, such as adding premium cabins, specialised seat configurations or bespoke in-flight systems, it can create turnaround delays and extra repair expenses. Such customisation requests have become a growing headache for some lessors, prolonging return timelines and inflating refurbishment costs. Lufthansa has also grappled with grounding some Boeing 787s because newly installed business-class seats failed to gain FAA certification, underscoring how even minor cabin tweaks can cause significant disruption.

To counter this, lessors and airlines are evolving their strategies. Lessor companies are also crafting more flexible lease terms to de-risk fleets and accommodate diverse airline needs, highlighting adaptation amid evolving market realities.

On the regulatory side, India's new legislation, aligning with the Cape Town Convention, strengthens lessor rights – especially in repossessing aircraft – which offers a safety net when customisations or defaults arise.

Leasing trends

The rise of aircraft leasing has reshaped global aviation. In this shifting landscape, new trends are emerging:

- Žiemelis believes ACMI or wet leasing is the growth segment of aircraft leasing. He said consultants have estimated the total global market size at $30bn (around 1,500 aircraft).
- Hakamo said she is seeing growing interest in more flexible and client-specific leasing models.
- Airbus and Boeing continue to struggle meeting delivery targets, resulting in a shortage of about 4,000 aircraft globally. This supply-demand imbalance is supporting strong lease rates, particularly the A320neo and 737 MAX.
- Leasing firms are embracing AI, blockchain, predictive analytics and digital twins to streamline tasks, like asset monitoring, contract tracking and fleet valuation. This fast-paced digital shift is enhancing operational efficiency and increasing transparency across the industry.
- Driven by aviation decarbonisation goals, lessors are increasingly offering ESG-linked lease financing[4] and prioritising deals with fuel-efficient aircraft, like A321neo and A350. Sustainability-linked instruments, such as green bonds and target-based lease terms, are gaining prominence.
- Sanctions, trade wars and regulatory changes are forcing lessors to rethink fleet strategies. New US tariffs on aircraft and aviation parts are affecting pricing, residual values and buying behaviour, pushing lessors to adapt by diversifying supply chains and restructuring lease agreements.
- According to KPMG[5], a key trend seen in aircraft leasing in the past couple of years is that airlines are increasingly choosing to extend leases instead of returning aircraft at the end of their terms. According to Air Lease Corporation Chairman, John Plueger, the company has seen a 100% lease renewal rate, as carriers prioritise retaining capacity amid ongoing aircraft shortages and high travel demand.

As the skies grow busier and markets become more dynamic, leasing is now not just an option – it is the engine powering the next chapter of air travel.

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Afterburner

www.aerosociety.com

Diary

25 September 2025

Airlines in South America 1920-1942: The German Influence

No.4 Hamilton Place, London W1J 7BQ

The Aeronautical Heritage Specialist Group's next lecture on 25 September explores the major role played by Germany in developing South American aviation between the wars. After WWI, companies like Kondor Syndikate and later Sindicato Kondor (Condor) helped establish airlines in countries like Brazil, Colombia, Peru and Bolivia. By the late 1930s, German-backed airlines dominated regional air travel, as well as providing scheduled connections to Germany via Zeppelin flights. With increasing Nazi influence from 1936, the US became concerned and pressurised South American governments to take control. An early example of this was the requirement for the companies to recruit local pilots. By 1941, the Germans had been forced out. The lecture by Capt Dacre Watson FRAeS will be illustrated by a full range of maps, timetables, and photos to bring these events alive. Watson was born in Chile to Norwegian-British parents and began his aviation career with BEA in 1965. He flew various aircraft, became a Captain in 1974 and served as a Training Captain until retiring from British Airways, later flying with Singapore Airlines. NAL/RAeS

46 Message from RAeS

– From our President

"I am looking forward to seeing Falcon 2 as it travels around the UK and internationally. Hopefully, funding will allow us to produce a number of these and we can extend the reach of this fantastic experience."

– From our Chief Executive Officer

"Young people remain curious, excited and ambitious about aerospace. The appetite is there but we are a relatively small sector trying to compete for airtime against industries that are louder, wealthier and far more embedded in young people's lives."

48 Library Additions

50 Falcon 2 Cleared for Take-Off
The RAeS' fully accessible flight simulator was unveiled at RIAT.

51 Diary
Upcoming Branch and HQ events.

52 Obituary
Pierre Jean Jeanniot.

53 Obituary
Lord Norman Tebbit.

54 International Air Cadet Exchange
Young people from across the globe convened on RAeS HQ on 21 July for the International Air Cadet Exchange.

55 Elections
Newly elected RAeS Fellows, Members and Affiliates.

55 From the Archives
The first UK-built SEPECAT Jaguar two-seat fighter trainer.

56 Royal Observer Corps remembered
A heritage plaque commemorating the ROC has been unveiled at Bentley Priory.

56 MP visits the NAL
Farnborough MP, Alex Baker, toured the National Aerospace Library in July.

57 New Member Spotlight
Senior Manager, Aerospace and Defence, Synopsis/Ansy, Valerio Viti.

Message from RAeS

OUR PRESIDENT

Alisdair Wood

> “I am looking forward to seeing Falcon 2 as it travels around the UK and internationally. Hopefully, funding will allow us to produce a number of these and we can extend the reach of this fantastic experience

In mid-July it was a pleasure to attend the Royal International Air Tattoo (RIAT) at RAF Fairford as it marked its 40th anniversary with a dazzling celebration of aviation excellence. The event drew more than 200 aircraft from around the world, showcasing cutting-edge technology and international co-operation. It is not just an airshow but a statement of aviation diplomacy, community, innovation and awe-inspiring flight.

The historical origin of the word ‘tattoo’ comes from a 17th Century Dutch expression *doe den tap toe,* literally meaning ‘turn off the tap’, a signal played by drummers or trumpeters to tell innkeepers near military garrisons to stop serving beer and for soldiers to return to their barracks. Over time, this nightly curfew signal evolved into the ceremonial performance we know today involving military bands, drills and displays of armed forces, showcasing discipline, heritage and pageantry.

The RIAT Friday evening gala dinner was certainly a memorable event. Who could fail to be moved as the band of the Royal Air Force played the national anthem as the BBMF Lancaster escorted by two Spitfires conducted a flypast? A number of awards were presented at the dinner and a special mention goes to the Pakistan Air Force which won the Spirit of the Meet Trophy, with the citation quoting recognition of ‘their efforts deploying a pair of indigenous fighter aircraft, on a 4,000 mile journey, alongside a tanker and special painted transport aircraft, and presenting them in a colourful and engaging static display’.

RIAT is not only a celebration of aviation excellence but also a commitment to inspiring the next generation through STEM activities. The Techno Zone was a noisy cacophony of hands-on STEM activities provided by organisations from a wide range of aerospace, aviation and space sectors. From building LEGO models, operating thermal cameras, testing computer skills in a cyber escape room to flying helicopters on a wind table, it was obvious that the target audience was having a great time. I hope many of them will be enthused to join our sector.

It was especially pleasing to be at the formal unveiling of the Falcon 2 simulator (see p50). As Chair of the Education and Skills Committee, I have had the pleasure of seeing the project develop from inception to the final product. Built on the experience of the Society’s Schools Build a Plane programme, one of the key priorities was to ensure the simulator was open to all. Guidance from Aerobility has helped greatly to achieve that aim and to give those of all abilities the experience of a feel of handling an aircraft with motion. Having understandably lost momentum during the pandemic, it is thanks to the determination and stamina of past President, Lee Balthazor and his team that we now see the final product. With transportability built in, I am looking forward to seeing Falcon 2 as it travels around the UK and internationally. Hopefully, funding will allow us to produce a number of these and we can extend the reach of this fantastic experience.

▼ With 2Excel Aviation founder, Chris Norton at the RAeS Summer Reception on 22 July. Jonathan Clare/RAeS

▲ Getting up close to the prototype Vertical Aerospace VX-4 at the Royal International Air Tattoo with test pilot, Si Davis. via Alisdair Wood

The theme for this year’s RIAT was ‘Eyes in the Sky’, highlighting airborne surveillance and intelligence capabilities and an array of machinery was on display on the ground and in the air. Among all of the past and present military hardware on display a number of civil products were also on show. It was particularly wonderful to see the Vertical Aerospace’s VX-4 prototype flown in for the event and I am grateful to test pilot, Si Davis who gave me an up-close tour of the aircraft and explained the programme. Whilst recognising there is a lot of work ahead to get to market, the dream is shaping up and becoming a reality.

Finally on the subject of RIAT 2025, a huge thank you to RTX, Leonardo and the RIAT hospitality team for hosting me during the weekend.

I cannot end without mentioning the summer reception at No.4 on 22 July. Sponsored by 2Excel Aviation, it was a great success and a wonderful opportunity to network. Chris Norton, 2Excel co-founder, gave an update on the company’s exciting work – both currently being undertaken and projects in the pipeline. With excellent cocktails and canapés, the discussions continued into the late evening and the balmy summer weather allowed us to spill out onto the terrace.

OUR CHIEF EXECUTIVE OFFICER

David Edwards

In aerospace, collaboration is a given – between systems, partners and nations. No single organisation designs, builds or flies an aircraft in isolation. Yet in our sector's charitable efforts, collaboration is not always the norm. Around 140 UK aerospace charities are doing vital, often life-changing work, but too often we do it alone.

As a registered charity, the Royal Aeronautical Society reaches some 10,000 young people, in your name, each year – widening participation, promoting aerospace careers and supporting future talent. But let's be honest: these efforts are often fragmented, overlapping or unintentionally duplicated with others. The very audiences we most want to engage with – young people, schools, and under-represented communities – are left to navigate a patchwork of initiatives rather than a coherent pathway.

Yet, when we do reach them, young people remain curious, excited and ambitious about aerospace. The appetite is there but we are a relatively small sector trying to compete for airtime against industries that are louder, wealthier and far more embedded in young people's lives. While Google, social media and global tech brands flood their screens and shape their aspirations, aerospace careers are too often hidden from view. Not by design but by a lack of co-ordinated visibility.

To meet the challenges of the next generation, aerospace charities need to stop competing for attention and start working collaboratively. Over the past two decades, we have seen what is possible when organisations align objectives, pool resources, and focus on outcomes. Programmes, like National Voices, the End Child Poverty Coalition and STEM Ambassadors have shown reach and impact precisely because they unite education, industry and the charitable sector behind a shared purpose.

The Society's own Cool Aeronautics programme, now in its second decade, has reached tens of thousands of primary-age children, many in schools that might never otherwise meet a pilot, engineer or space scientist. These are not just moments of inspiration; they are moments to change trajectories.

Equally, organisations, such as The Air League and the British Women Pilots' Association have shown how a scholarship flight, a site visit or a bursary can open doors that would otherwise remain shut. However, capacity is constrained, volunteers are stretched and funding is finite and shrinking. When charities fail to work together, we all lose. Schools receive multiple unaligned offers, funders see overlapping bids and 'outreach fatigue' sets in. Critically, young people encounter a sector not as a clear and welcoming pipeline but as a disconnected series of touchpoints. Sometimes this is unintentional – a passionate founder sees a gap and acts but, without integration, scaling becomes difficult. In other cases, fragmentation is reinforced by brand protectionism, limited visibility or reluctance to share data. The result is a sector that, while rich in energy and ideas, lacks cohesion.

This is not a call for mergers. The diversity of missions in aerospace outreach is a strength – but we urgently need shared infrastructure, co-ordinated calendars, consistent evaluation, aligned messaging and clearer signposting. Government has gestured at this in the past, but a national framework, co-owned by charities, industry and professional bodies, is both achievable and overdue.

As you can probably sense, I am a little bit frustrated, if not deflated. Every month I learn of another great idea that someone has had and another charity started. Invariably, this leads to further duplication and, ultimately, more undelivered aims. We cannot keep doing this to ourselves.

To help catalyse the process, we are convening a UK Aerospace Charity Symposium on 1 December – bringing together organisations from across the landscape. The goal is simple: talk, align and identify new opportunities for shared impact. Not centralisation, but connection.

As a neutral convenor with a 160-year commitment to aerospace education, we are well placed to foster collaboration. If you lead an organisation in the space please attend and please spread the message. Please email events@aerosociety.com to attend.

Imagine if a school could access a single platform showing local outreach offers, linked to national programmes and with follow-up pathways in place. Imagine if funders could measure cumulative impact, rather than project-by-project metrics. Imagine if a young person could see where a one-day visit might lead – to an apprenticeship, a degree or even a flying licence.

Greater co-ordination would also help address the sector's stubborn inclusion gap. A joined-up ecosystem would offer fairer access to every student, in every region, from every background. The workforce challenge ahead is existential and, as we highlighted as early as 1995, the sector must prepare for a future shaped by automation, sustainability and global competition. That demands a new generation of thinkers, makers, and leaders and charities are not a peripheral part of that equation – they are essential to it. The past 20 years have shown us what works: long-term partnerships, purposeful design and a clear focus on the young person's experience. The next 20 will depend on whether we choose to collaborate and build something collective.

In aerospace, we are used to systems integration. It is time we applied the same discipline to our social mission.

> “Young people remain curious, excited and ambitious about aerospace. The appetite is there but we are a relatively small sector trying to compete for airtime against industries that are louder, wealthier, and far more embedded in young people's lives

Library Additions

BOOKS

AIRSHIPS

Airships: Their Science, History and Future by Iver P Cooper, 1st ed, 2025, McFarland & Company, 379pp.

Many know of the Hindenburg disaster in 1937, but few realise it had completed 62 flights beforehand. Despite the tragedy, airships continued to serve in military roles during World War II and beyond, and new models are still being developed today. This book explores the history, science, and engineering of airships, including their design challenges and potential future uses.

AIRCRAFT DESIGN AND CONSTRUCTION

Advanced Aircraft Flight Performance: Including Environmental Performance by Antonio Filippone, 2nd ed, 2022, AIAA, 831pp.

This revised second edition reflects a renewed focus on environmental sustainability, digitisation, and advanced propulsion technologies. With growing awareness of climate impact, aircraft performance is now closely tied to emissions, supported by vast digital data from onboard and streamed sources.

Advances in Aerospace Technologies by Devabrata Sahoo et al, 1st ed, 2024, River Publishers, 263pp.

Features recent technological advances in aerospace engineering, covering key research areas such as aerodynamics, wind tunnel testing, and computational fluid dynamics. It reviews innovations across critical topics including satellites, supersonic/hypersonic inlets, advanced composite structures, green propellants, satellite design and control, Industry 4.0 application and AI in aerospace.

Aircraft Cryogenics by Ernst Wolfgang Stautner, 1st ed, 2024, Springer, 340pp.

A step-by-step guide to designing cryogenic infrastructure for superconducting, all-electric aircraft, with applications to liquid hydrogen-fuelled subsonic, hypersonic, and hybrid aircraft. Key topics focus on enabling liquid hydrogen storage and distribution in aircraft.

Aircraft Design: a Conceptual Approach by Danield P Raymer, 7th ed, 2024, AIAA, 1,142pp.

Covers all essential aspects of aircraft design from the designer's perspective and concludes with in-depth chapters on more exotic vehicles, including electric aircraft, VTOL jets, hypersonic craft, and more.

Derivative-Free Adaptive Control by Tansel Yucelen & Anthony J Calise, 1st ed, 2023, AIAA, 126pp.

This book presents Derivative-Free Model Reference Adaptive Control (DF-MRAC), a novel alternative to traditional MRAC.

Fundamentals and Aerospace Applications of Prescribed Performance Control by Caisheng Wei, 1st ed, 2025, Springer, 406pp.

Presents the latest advances in prescribed performance control theory, covering challenges like incomplete state information, actuator saturation and faults, constrained communication bandwidth and task time window and collision avoidance. It details controller design, analysis, and simulations for aerospace applications such as spacecraft control and space robotics.

History and Evolution of Aircraft by Technological Advancements in Size, Speed, Armaments, and Engines by Ahmed F El-Sayed, 1st ed, 2025, CRC Press, 656pp.

A history of aviation from early history to the present day, covering military and civil aircraft, helicopters, drones, balloons, airships and engines. It examines the evolution of manned and unmanned vehicles, engine types, and flight technologies across air, sea, and amphibious platforms. Highlighting current UAV applications and future concepts like jetpacks and flying vehicles, it also details advancements in aircraft design and propulsion systems.

Introduction to Aircraft Flight Mechanics by Thomas R Echout, 3rd ed, 2024, AIAA, 794pp.

Revised and expanded edition of this introductory textbook for undergraduate aeronautical engineering students. It clearly explains the concepts and derivations of equations involved in aircraft flight mechanics. It begins with a review of basic aerodynamics and propulsion and continues through aircraft performance, equations of motion, static stability, linearising equations of motion, dynamic stability, classical feedback control, stability and control augmentation, bode, state space and special topics.

Introduction to Generative Design for Aerospace Applications: From the Creative Process to Manufacturing by Diego Carou, 1st ed, 2025, Springer, 107pp.

Offers a comprehensive introduction to generative design in aerospace, covering the journey from concept to manufacturing. It explores sustainable methods, advanced technologies, AI-driven design and manufacturing and topology optimisation.

Systems Engineering for Commercial Aircraft: a Domain-Specific Adaptation by Scott Jackson, 3rd ed, 2025, CRC Press, 372pp.

Examines aircraft as complex, systems-engineered entities that prioritise safety, integrating humans and technology to reduce fatalities and improve reliability. The third edition focuses on Deming's definition of quality and explores in more detail risk and resilience.

AERODYNAMICS

Dynamics of aircraft flight by Giles Louis, 1st ed, 2022, John Wiley & Sons, 83pp.

Presents a theoretical approach to flight mechanics that makes it possible to grasp the subject and links it with the empirical approach of manufacturers.

Hypersonic and high-temperature gas dynamics by John D Anderson Jr, 3rd ed, 2019, AIAA, 869pp.

A self-contained, accessible text for learning hypersonic flow and high-temperature gas dynamics, requiring no prior knowledge. It presents fundamental concepts, key theories and developments.

Hypersonic Slender Body Aerodynamics by Ethirajan Rathakrishnan, 1st ed, 2025, John Wiley & Sons, 202pp.

A comprehensive guide to the theory and applications of hypersonic slender body aerodynamics with numerous examples, figures, and exercises. It spans from the definition of slender body geometry to flow field analysis and calculation of aerodynamic and thermal loads across speed ranges. Topics include the Mach number independence principle and approximate theories for caret wings.

Instrumentation and Measurements in Compressible Flows by Mrinal Kaushik, 1st ed, 2024, CRC Press, 337pp.

Detailed information on experiments in compressible fluid flows including technical information pertaining to a wide variety of applications and the experimental basis for compressible flows. Provides a step-by-step procedure for estimating measurement errors and uncertainty and gives results for validating computational fluid dynamics data. It also covers measuring the data at very high speeds.

Introduction to Aeroelasticity James DeLaurier, 1st ed, 2024, Taylor & Francis Group, 196pp.

An introduction to the classic topics of aeroelasticity for undergraduate or graduate students, as well as any engineer wishing a thorough introduction to the topic.

Introduction to Unsteady Aerodynamics and Dynamic Aeroelasticity by Luciano Demasi, 1st ed, 2024, Springer, 804pp.

Introduces unsteady aerodynamics and dynamic aeroelasticity, covering key methods like the Doublet Lattice Method for nonplanar wings. It explains flutter prediction techniques, distinguishes between cantilever flutter and body freedom flutter, and explores nonlinear aeroelasticity of joined wings and innovative wing systems.

Optical diagnostics for reacting and non-reacting flows: theory and practice by Adam Steinberg et al, 1st ed., 2022, AIAA, 1321pp.

An introductory guide and a reference for experienced practitioners focusing on laser-based, non-invasive methods for visualising and quantifying species concentrations, thermodynamic properties, and fluid dynamics in reacting and non-reacting flows. These can be applied to real-world engineering systems such as engines and wind tunnels.

ACOUSTICAL ENGINEERING

Noise and vibration analysis: signal analysis and experimental procedures by Anders Brandt, 2nd ed, 2023, John Wiley, 707pp.

This practical guide combines signal processing and modal analysis theory with real-world applications in noise and vibration analysis. Updated with new chapters on experimental and operational modal analysis and practical vibration measurements.

AVIONICS

Aircraft communications and navigation systems by Michael H Tooley, 3rd ed, 2024, Routledge, 366pp.

Introducing the principles of communications and navigation systems, it is written for anyone pursuing a career in aircraft maintenance engineering or a related aerospace engineering discipline, and in particular will be suitable for those studying for licensed aircraft maintenance engineer status. This updated edition provides an overview of the latest key technologies that underpin the functioning of safety-critical systems such as those used in flight management, reporting, navigation, and air traffic control.

Developing digital RF memories and transceiver technologies for electromagnetic warfare by Phillip E Pace, 2022, Artech House, 892 pages.

This guide covers the latest advancements in Digital RF Memory (DRFM) technology and their key role in maintaining dominance over the electromagnetic spectrum. Part I focuses on designing transceivers for spectrum sensing with unmanned systems, while Part II explores AI and machine learning for spectrum sensing and detection signal processing for electronic support and electronic attack. It also addresses counter-DRFM techniques and includes MATLAB software for building custom DRFM transceivers.

BIOMIMICRY

Biomimicry for aerospace by Vikram Shyam, Marjan Eggermont, Aloysius F. Hepp, 2022, Elsevier, 528pp.

An exploration of what humanity can learn from the natural world to solve technical challenges in aeronautics and space exploration and focusing on the latest advances of bioinspired materials–properties relationships for aerospace applications.

MATERIALS

Advances in Manufacturing for Aerospace Alloys by Selim Gurgen, 1st ed, 2024, Springer, 182pp.

Highlights the limitations of traditional methods and the rise of nonconventional techniques like additive manufacturing, laser welding, and EDM for manufacturing operations and processes related to aerospace alloys. Combining theory with practical applications, it serves as a key reference for researchers and engineers.

Aluminum Technologies in Aerospace Applications by Selim Gurgen, 1st ed. 2025, Springer, 225pp.

Explores the latest advancements in aerospace-grade aluminium alloys and their transformative applications. It covers innovations such as aluminium matrix composites, fibre metal laminates, grain refinement, and emerging manufacturing methods like friction stir welding. Offers practical insights and case studies.

Failure in Aircraft Materials by Selim Gürgen, 1st ed, 2024, Springer, 131pp.

Combines theory and case studies to explore common failure modes in aircraft alloys, including wear deformation, fracture characteristics, fatigue failure, stress corrosion cracking and creep.

Joining Operations for Aerospace Materials by Selim Gürgen, 1st ed, 2024, Springer, 160pp.

Offers in-depth knowledge of aerospace material joining focusing on essential methods and techniques for building durable, high-performance structures. It highlights the latest advancements in metallurgical and mechanical joining, providing a comprehensive guide to mastering aerospace manufacturing processes.

Materials for land, air, and space transportation by Yinquan Yu, Sam Zhang, 1st ed, 2025, CRC Press, 392pp.

Explores development of new materials for transportation, focusing on physical properties, research theories, processing technologies and high-precision inspection. Key topics include nanotechnology, additive manufacturing and structure-sensitive properties of materials.

MATHEMATICS AND COMPUTERS

Engineering Computations and Modeling in MATLAB/ Simulink by Oleg A Yakimenko, 2nd ed, 2020, AIAA, 957pp.

A broad overview of the MathWorks' MATLAB/ Simulink/GUIDE/App Designer development and modelling environment showing how to use these software tools effectively in a variety of engineering applications, including modelling real-world dynamic systems.

Advanced Modern Engineering Mathematics by G James & Phil Dyke, 7th ed, 2018, Pearson, 1013pp.

Provides treatments of some of the more advanced areas of mathematics used in engineering, particularly those used as tools for computer-based system modelling analysis and design.

Situation Assessment in Aviation: Bayesian Network and Fuzzy Logic-Based Approaches by J R Raol, 1st ed, 2024, CRC Press, 435pp.

This book explores emerging soft computing technologies such as multisensory data fusion, Bayesian networks (BN), and fuzzy logic (FL) for improving situation assessment in aviation. It examines how these tools support pilot decision-making in tasks. Key concepts include situation awareness, decision fusion, and hybrid techniques combining BN and FL. The book also introduces AI-based approaches for advanced automated systems.

Mathematical Modelling of Aerospace Dynamic Systems with Practical Applications by J R Raol, 1st ed., 2025, CRC Press, 320pp.

Provides mathematical models for dynamic aerospace systems including aircraft, rotorcraft, missiles, UAVs, mini air vehicles (MAVs) and satellite-coordinate systems - used for analysis, prediction and control. Applications include parameter estimation, navigation, terrain mapping, orbit determination, and target tracking. It covers path planning, obstacle avoidance, sensor fusion, and occlusion detection.

PROPELLERS

Propeller Design by Ohad Gur, 1st ed, 2024, AIAA, 348pp.

This book fills a gap in modern literature by focusing exclusively on propellers, unlike most texts on helicopters or general aerodynamics. With the rise of UAVs, multi-blade drones, and VTOL air taxis, it addresses the growing need for specialised knowledge.

SPACE

Rocket Propulsion Primer by Subramaniam Krishnan, 1st ed, 2024, Springer, 427pp.

Covers fundamentals of rocket propulsion such as history, classification, qualitative design, quantitative design of internal ballistics and rocket vehicle optimisation.

Design of rockets and space launch vehicles by Donald L Edberg & Guillermo Costa, 2nd ed., 2022, AIAA, 1107pp.

A comprehensive exploration of rocket design, engineering, manufacturing, and testing for aerospace engineering students and professionals. Offers practical insights and illustrated examples.

Analytic Methods of Orbit Prediction and Control: Low-Thrust and Impulsive Propulsion Applications by Jean Albert Kéchichian, 1st ed, 2023, AIAA, 345pp.

This book explores analytic methods for orbit prediction and control, focusing on low-thrust and impulsive manoeuvres. It assesses their accuracy compared to numerical solutions and considers future autonomous on-orbit navigation, including shadowing effects in electric propulsion.

Optimal Trajectory Estimation for Missile Defense Applications by Michael E Hough, 1st ed, 2024, AIAA, 399pp.

Applies modern estimation theory to aerospace trajectory estimation. The topics cover key challenges and real-world complexities.

Planetary Exploration with Ingenuity and Dragonfly by Ralph Lorenz, 1st ed., 2022, AIAA, 211pp.

A guide for 'space people' on what they need to know about rotorcraft, and for 'helicopter people' on what they need to know about operating machines on other planets.

UAVS

How Drones Fight: How Small Drones Are Revolutionizing Warfare by Lars Celander, 1st ed, 2024, Casemate Publishers & Book Distributors, 209pp.

Examines the impact of drones on modern warfare, detailing their navigation, communication, sensors, and weaponry. Drones have revolutionised ground combat by enabling precise strikes, reconnaissance, and artillery targeting with minimal risk to soldiers. While some are piloted, others operate autonomously. Despite their effectiveness, drone technology is still in its infancy, comparable to early aircraft in WWI. Celander explores drone capabilities, counter-drone tactics, and their evolving role in future warfare.

Unmanned Aircraft Design: A Review of Fundamentals by Mohammad H Sadraey, 2nd ed, 2025, Springer, 223pp.

This book covers the fundamentals, design processes, and tools for UAV systems, with a focus on vehicles, autopilot and ground system design. It highlights the unique challenges of UAV design and reflects on lessons from past and current technologies.

HUMAN FACTORS

Aerospace Psychology and Human Factors: Applied Methods and Techniques Ioana V Koglbauer & Sonja Biede-Straussberger, 1st ed, 2025, Hogrefe Publishing, 290pp.

Examines the crucial role of the human element in aerospace amid evolving technological and societal challenges. It covers system safety engineering, cockpit, cabins and spacecraft design, AI-driven assistance systems and human factors integration along with extended reality technologies for enhancing operator perception and space exploration.

SAFETY

History and Development of Airline Cabin Safety by Fons Schaefers, 1st ed, 2025, Taylor & Francis Group, 350pp.

Offers an understanding of how cabin safety evolved over time. It covers six key areas: impact protection, fire protection, egress potential, life support equipment, information and instructions, and cabin professionals.

CIVIL AVIATION HISTORY

100 Years of Civil Aviation: A History from the 1919 Paris Convention to Retiring the Jumbo Jet by Ben Skipper, 1st ed, 2023, Pen & Sword, 285pp.

A history of the design and development of civil aircraft and all the personalities that shaped the civil aviation industry during the hay-day of air travel before the advent of mass passenger transit, and the rise of smaller, austerity airlines. Additional topics include the influence of military aircraft on civil planes, civil aviation law, air disasters, the role of women in civil aviation, rescue missions and covert operations and testing and transporting of aircraft by civilian pilots.

AIRPORTS

The Evolution of Airport Design by Robert Stewart, 1st ed, 2024, Routledge, 349pp.

A comprehensive account of the evolution of airport design, from the start of commercial aviation in 1919 to the present day. The book rigorously considers why, where, when and how the ideas we now take for granted originated using worldwide case studies.

Airport Marketing Strategies: Aviation and Tourism Perspectives by Lazaro Florido-Benitez, 1st ed, 2024, Emerald Publishing, 217pp.

The perception of airports by tourists and business travellers has greatly improved, largely due to strategic marketing by airport operators. Once seen merely as functional transport hubs, airports are now central to transportation, tourism and logistics. This book examines modern airport marketing strategies in the digital age, offering a perspective on how these boost commercial revenue and brand image.

AIRPOWER

How Strategic Airpower Has Changed the World Order: From the 100th Bomb Group in 1943 to the Falklands and Beyond by Nigel David MacCartan-Ward, 1st ed, 2024, Pen & Sword

This book illustrates how both land- and carrier-based strategic air power is essential to maritime deterrence in a complex world. Through the stories of WW2 B-17 *Quittin' Time* and 'Sharkey' Ward's Sea Harrier in the Falklands War, it highlights the enduring relevance of airpower.

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Society News

FALCON 2 CLEARED TO TAKE-OFF

The UK's newest accessible flight simulator, Falcon 2, took off in style with its official launch at July's Royal International Air Tattoo (RIAT). Partnering with Boeing, Aerobility, Middlesex University and Coventry University, the programme aims to inspire young people – particularly those with Special Educational Needs and Disabilities (SEND) – by making the wonder of flight accessible to all.

The launch began with speeches by Steering Group chair, Lee Balthazor and current RAeS President, Alisdair Wood with the official ribbon cut conducted by Malcolm Brecht CB CBE, Director C-17 International Programme Integration & Field Services at Boeing. It ended with a flight from none other than astronaut, Tim Peake – proving that Falcon 2 has the power to inspire even those who have been to space.

The simulator quickly drew crowds. Across its first seven hours, 38 participants took to the virtual skies – 29% of them wheelchair users or individuals using walking aids. Feedback was instant and heartfelt with comments including: "Faffless, easy to get in and out," and "the ease of use, the great staff and how little dexterity was needed to enjoy it."

Saturday saw 73 flights, including 18 from participants with disabilities (25%). One standout was Felix, a young man whose parents were delighted at how independently he could access the simulator. His father noted that other simulators would have required lifting him in—something Falcon 2's design eliminates.

Sunday's 68 flights included 19 accessible sessions (28%). Among them was a visitor who had learned about Falcon 2 from a Friday attendee's social media post. They came straight to the stand, declaring afterwards: "I'm a pilot. That was a dream come true – please come to my school."

Across three days, the numbers told their own story:

- 179 flights in total
- 48 accessible flights (27%)
- 100% positive feedback from participants and families

Engineering Inclusion

Falcon 2 is testimony to what happens when engineering ingenuity meets a mission for inclusion. Aerobility has long pioneered adaptations that allow disabled people to fly real aircraft, sometimes even earning their pilot licence.

Falcon 2 extends that ethos into schools and public spaces, offering an aviation experience without physical barriers. RIAT's Falcon 2 launch proved that aerospace is at its best when it welcomes everyone to the controls. With nationwide tours ahead, one thing is certain: many more will soon be able to say "I'm a pilot."

▶ ESA astronaut, Tim Peake was among the first to get behind the controls of Falcon 2 on the opening day of RIAT 2025 at RAF Fairford.
Saurav 'Roy' Chowdhury/RAeS

▲ Eager young people queuing to be among the first to experience Falcon 2.
Tim Robinson/RAeS

Inside Falcon 2

Falcon 2's accessible cockpit is the result of a bespoke engineering project, blending aviation realism with barrier-free design. Here are a few highlights:

Cockpit Layout: Custom-built pneumatic platform, designed and constructed by Middlesex University, allowing participants to roll straight in using their own wheelchair without transfers or lifting.

Controls: Fully adjustable joystick system, adaptable in height, angle and resistance to suit any user's needs.

Display System: High-brightness projector paired with a 78-inch screen, delivering a wide, immersive visual field for an authentic flight experience.

Accessibility Features: Low-gradient access ramp and unobstructed entry ensure smooth, independent boarding for wheelchair users.

Software: Powered by X-Plane, offering high-fidelity flight physics and a wide range of aircraft and scenarios.

Mobility: Self-contained, road-ready unit enabling rapid deployment to schools, airshows and public events nationwide.

This combination of precision engineering and universal design makes Falcon 2 a unique platform and one that opens up the skies to everyone.

Dominic Hilton
RAeS Education and Skills Executive

▶ Falcon 2 has been designed to be easily transportable to enable it to visit schools and public spaces around the UK. Seen here, Coventry University's Dr Rashid Ali welcomes members of the RAF Aerobatic Team, The Red Arrows, to the simulator.
Saurav 'Roy' Chowdhury/RAeS

Diary

EVENTS

3 September
North Wiltshire Branch: Building Blue Danube – Britain's first atomic bomb
Jonathan Aylen – Senior Visiting Research Fellow, University of Manchester
The Deanery CE Academy, Swindon SN1 7DA

8 September
Prestwick Branch: The History of The National Museum of Flight at East Fortune and Present Restoration Projects
Thilo Bürgel, Conservator at the National Museum of Flight at East Fortune
University of the West of Scotland, Ayr Campus, University Avenue, Ayr KA8 0SX

10 September
Weybridge Branch: What really happened to the Concorde at Gonesse?
Alan Simmons FRAeS, International Society of Air Safety Investigators
Brooklands Museum, Brooklands Road, Weybridge KT13 0QN

10 September
Brough Branch: Written in the stars – The story of the A321XLR certification flight test campaign – helicopter operations
Jim Fawcett MRAeS, Lead Flight Test Engineer and Mark Lewis FRAeS Airbus Test Pilot.
Cottingham Parks Golf & Leisure Club, Woodhill Way, Cottingham HU16 5SW (and online)

11 September
Bedford Branch: Outside of the box – helicopter operations
Jack Harding, Helicopter Pilot, Northern Helicopter GmbH
ARA Sports and Social Club, 2000 Manton Ln, Manton Industrial Estate, Bedfordshire MK41 7PF (and online)

12 September
RAeS Young Professionals Conference 2025 – Wings of Change: The Rise of Young Visionaries
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

16 September
Farnborough Branch: Light Years Ahead – The 1969 Apollo 11 Moon Landing Computer
Robert Willis, Software Engineer, Cisco
Farnborough College of Technology, Boundary Road, Farnborough GU14 6SB

17 September
RAeS Late Summer Air Law Reception 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

17 September
Preston Branch: Racing gliders
Venue TBC

18 September
RAeS Amy Johnson Named Lecture 2025: MRO Through the Ages and Beyond: Safeguarding Airpower from Propellers to AI Wings
Smriti Hamal, Senior Air Safety Consultant at AtkinsRéalis
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

18 September
Birmingham, Wolverhampton and Cosford Branch: The story of RAF Defford
David Roberts
RAF Museum Midlands, Shifnal TF11 8UP

18 September
Yeovil Branch Winkle Brown Dinner and Lecture: Commando Helicopter Operations Behind the Lines
Lt Alan 'Wiggy' Bennett DSC RN (Retired)
Wardroom Mess, RNAS Yeovilton, Heathcote Road, Yeovil BA22 8HT

18 September
Belfast Branch: Grumman Piston Engine Fighters
Rod Dean
David Keir Building, Queen's University Belfast, Stranmillis Road, Belfast BT9 5AA

25 September
RAeS Lecture: Airlines in South America 1920-1942 – The German influence.
Capt Dacre Watson
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

6 October
RAeS Mental Health Awareness Day
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

7-8 October
RAeS President's Conference 2025: People in Aerospace
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

8 October
Preston Branch: Electric Aircraft Update
Venue TBC

9 October
Bedford Branch 2025 Sir John Charnley Lecture: Westland100 – Horseless Carriage to Helicopters (via low Earth orbit)
Dr Alisdair Wood FRAeS, President, Royal Aeronautical Society
Aircraft Research Association, Sports and Social Club, Manton MK41 7PF

14 October
Loughborough Branch: Flying Concorde
Capt John Tye, Former Concorde Pilot
Brockington Building, Margaret Keay Rd, Loughborough LE11 3TU

16 October
Birmingham, Wolverhampton and Cosford Branch: Flying Vintage Jet Aircraft
Rod Dean
RAF Museum Midlands, Shifnal TF11 8UP

21-22 October
RAeS Flight Simulation Conference 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

23 October
Celebrating National Mentoring Day 2025
Ruth Mallors-Ray FRAeS
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

4 November
Loughborough Branch: The life and times of FLYBY Technology
Annalisa Russell-Smith FRAeS, Chief Strategy Officer, Flyby Technology
Brockington Building, Margaret Keay Rd, Loughborough LE11 3TU

5 November
Careers in Aerospace and Aviation Live 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

10 November
RAeS Light Aircraft Design Conference 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

12 November
Preston Branch: Young Persons Network Mini Lecture Competition (1)
Venue TBC

12 November
Brough Branch: Embedding conscience in drones and robots?
Dr Rashid Ali FRAeS
Cottingham Parks Golf & Leisure Club, Woodhill Way, Cottingham HU16 5SW

14 November
Celebrating LGBTQ+ People in STEM 2025
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

18 November
Loughborough Branch: UltraFan Demonstrator – First Engine to Test
Brockington Building, Margaret Keay Rd, Loughborough LE11 3TU

20 November
RAeS Weapon Systems Weapon Integration Conference
Royal Aeronautical Society HQ, No.4 Hamilton Place, London W1J 7BQ

20 November
Birmingham, Wolverhampton and Cosford Branch: Stalin's Night Witches
Debbie Land
RAF Museum Midlands, Shifnal TF11 8UP

For further information and booking, visit **aerosociety.com/events-calendar/**

Obituary

PIERRE JEAN JEANNIOT

FRAeS
1933-2025

After a varied and distinguished career in aeronautical leadership, Pierre Jean Jeanniot died peacefully in Montreal on 22 June at the age of 92, survived by his wife Marcia and their three children.

Born in Montpellier, France, Jeanniot arrived in Canada as a teenager with his mother. After finishing high school, his first job was as a draftsman at Northern Electric. He remained intent on continuing his studies but his only option was to attend Sir George Williams College (later Concordia University). This proved challenging since he was unilingual in French. Nonetheless, he persevered with self-study to become fluently bilingual. Always a self-made pioneer, he attended university at night, completing his BSc in Physics and Mathematics.

In 1954, Jeanniot began his professional career with government-owned Trans-Canada Air Lines (TCA) as a junior quality control technician, holding roles in flight and commercial services, spending years climbing through the ranks and becoming the first Francophone to head the traditional Anglophone airline enclave.

In 1963, a TCA Douglas DC-8 crashed shortly after take-off from Dorval Airport with the loss of 118 lives. In the aftermath of this disaster, as a maintenance division chief, Jeanniot helped develop a comprehensive flight data recorder designed to track wide-ranging parameters, yet survive the extreme conditions following a catastrophic aircraft event. For this, he is credited with having created the first modern 'black box', a milestone in aviation safety.

In January 1965, TCA officially became Air Canada and with the transformation, Jeanniot's career continued to rise steadily. He became Director of the Computer Systems and Communications Division which, in 1970, developed a computer reservations system. In 1970, he oversaw implementation of applications for system operations, flight planning, resource allocation and flight information displays.

On becoming Executive Vice-President and Chief Operating Officer in 1983, Jeanniot oversaw the introduction of business class flights and industry-first innovations, such as non-smoking flights. He was known to disagree with long-time Air Canada President and CEO, Claude Taylor, on several subjects, including a strategic vision for the airline.

In 1984, he received a telephone call from Prime Minister Pierre Elliott Trudeau to inform him that his ministers thought he would be the best choice to become Air Canada President, replacing Taylor and offered him the position. When asked to suggest a new Chairman, Jeanniot graciously nominated his long-standing rival, Taylor, but this only infuriated the former incumbent. Insiders contend that their opposing viewpoints seemingly arose from several source's including the former's liberalism and the latter's conservatism, as well as their respective approaches to privatisation of Crown corporations, like Air Canada.

Jeanniot oversaw the safe introduction of widebody, twin-engine flights on transatlantic routes and later on non-stop flights between Vancouver and Frankfurt. Under his direction, Air Canada established the first datalink over the Atlantic, enabling flight information to be transmitted electronically and automatically rather than by radio.

In September 1984, Canada's then Prime Minister, Brian Mulroney mandated preparations for Air Canada's privatisation, which was launched in 1988. Jeanniot's vision was for the carrier to become a significant player in the global market, while Taylor wanted to focus on traditional markets in Canada and the US. The sale of Air Canada was completed in 1989 and in August 1990, Air Canada announced that Jeanniot would take early retirement. No public explanation for his departure was offered but he later recalled that the board had decided his international strategy for the airline was too ambitious and had to be curtailed. Taylor returned as CEO while the airline searched for a replacement.

In 1993, Jeanniot was elected Director General and CEO of the International Air Transport Association (IATA), moving to Geneva, Switzerland and serving until 2002. He restructured the governance process and increased membership from 200 to 280 airlines, including – for the first time – several Chinese carriers. During his tenure, IATA became a major supplier to the aviation industry, providing technical and financial services, and training expertise. Through its participation in ICAO, IATA became instrumental in shaping significant global aviation policies.

Jeanniot was deeply committed to academia, serving as Chairman of the board and later first Chancellor of the Université du Québec à Montréal (UQAM). He helped establish the UQAM Foundation and created the Pierre J Jeanniot Fund, supporting students in music, mathematics, education and management.

He was recognised nationally and internationally for his contributions, including Officer of the Order of Canada , Chevalier of the French Legion of Honour and *Chevalier of the Ordre national du Québec* as well as being awarded honorary doctorates from McGill, Concordia and Université du Québec, and being inducted into the Quebec Air and Space Hall of Fame. On completing his tenure, he was elected Director General Emeritus of IATA in recognition of his contributions to civil aviation worldwide.

Capt Don Van Dyke FRAeS
RAeS Permanent Representative to ICAO

LORD NORMAN TEBBIT

CRAeS
1931-2025

Lord Norman Tebbit, who has died at the age of 94, has long since secured his place in history – particularly from the aspirational lower middle and working-class Conservative part of politics – as one of the most formidable and eloquent voices of the Thatcher years. Yet long before his political career began, aviation was a driving passion – and it remained so throughout his life. His journey spanned the dawn of the jet age, the 'classic' era of British civil aviation, and the transformation of the modern nation that he helped to mould.

Born in Ponders End, Middlesex in 1931, Tebbit grew up in the shadow of the Great Depression. After attending Edmonton County Grammar School and national service, he joined the RAF, flying Meteors and Vampires. It was a time that demanded cool, calm, clear judgement and mastery of new, high-performance machines. He often credited his flying days with nurturing his appreciation for discipline, accuracy, and self-reliance: qualities that became his hallmark in public life.

These were dangerous, pioneer days in aviation. In 1954, while flying a Meteor F.8 from RAF Waterbeach, he crashed on landing and escaped from the burning wreckage only by breaking open the canopy. It was a moment that captured his hallmark composure under pressure – a quality that would define not just his time in the cockpit but his entire public life. Decades later, when Theresa May remarked that the 'naughtiest' thing she'd ever done was run through a wheatfield, Tebbit recalled dryly: "Mrs May may have run around in a cornfield – I finished up in a burning aeroplane setting light to a cornfield!" The RAF pilot's banter never left him.

When he left the RAF, he became a commercial pilot for BOAC, flying long-haul routes during a vital expansion period for global air travel. He also represented pilots on the flight deck for the British Airline Pilots' Association (BALPA) – an influential experience for him – cementing his reputation among colleagues as a calm, highly skilled, and intellectually sharp professional.

Tebbit entered Parliament in 1970, first as the Conservative MP for Epping, then for Chingford. He brought his aviation background with him and quickly became aviation's voice in Parliament – despite his declared reluctance to be BALPA's spokesman – on everything from safety and the then-prevalent scourge of hijacking to Rolls-Royce's RB211 and eventual nationalisation, to the Laker Skytrain case. As early as 1970, he questioned why BOAC and BEA remained nationalised when they operated as commercial airlines, a clear early signal of the deregulatory, private sector instinct that would later define his ministerial career.

In 1973, determining that he "had better get on with [his] political career" he decided to speak more often in Parliament. Airport expansion – in this case the 'Maplin Development' (a 'Boris Island'-style, third London airport – albeit whilst Boris himself was still at school) — was his chosen subject, which he considered "ludicrous."

While "with Stansted airport only just outside [his] constituency" he had to "tread warily" on airports policy, he felt that his opposition to the Roskill Report's "huge new four-runway airport" was soundly based. Interestingly, Tebbit lamented that he felt it was "a pity that [his] suggestion of maximising the potential of Gatwick by the construction of a second runway was not taken up." Tebbit's autobiography makes interesting reading on the topic of aircraft noise, where he is clear – writing in the late 1980s – that "now that the old noisy jets have been banned and modern engines set a new standard of low noise and absence of smoke it is hard to remember how dirty and noisy the early jetliners were". Most importantly, Norman's thoughts on the importance of new technology in solving noise and - even then – the environmental effects of aviation would be well worth re-reading by some politicians today.

All of which rather proves that very little is truly new in the political world: some highly topical issues never change. Moreover, he was notably ahead of his time in advocating for greater inclusion in aviation, particularly championing women pilots. In 1971, he publicly challenged British European Airways' refusal to consider a qualified woman for pilot training, accusing the airline of enforcing a "blatant sexual bar". It was a stance far ahead of its time and typical of a man who prized merit over orthodoxy. Whether in the cockpit, the Commons or the Lords, Tebbit never hesitated to speak plainly. He rarely missed his target.

Although he never formally held a named transport or aviation brief, Tebbit's deep-seated interest in industrial and economic reform – covering not just airport policy but everything from aerospace to baggage handling – left a profound and lasting mark on the sector.

As he recalled, "most of [his] time at the Department [of Trade] was taken up with civil aviation issues" for which he was directly responsible. So he led the Civil Aviation Bill, which set out plans to reduce the state's role in running airlines, encourage competition by giving private carriers greater scope to expand, adjust the powers and remit of the CAA, and create a policy environment in which British Airways could operate on fully commercial terms - marking the early stages of British Airways' privatisation.

Lord Tebbit grasped, perhaps more than many politicians of his time – or indeed many in our own time – the importance of balancing regulation with

the realities of a commercial global industry. Those who – like this author – encountered him in the House of Lords, especially when discussing topics of aviation safety, air traffic control, innovation, or military procurement, found a voice unfaltering in its belief in national expertise and practical sense, and always steadfast in rejecting political jargon.

As a former Aviation Minister, I recall the almost surreal experience of being thoroughly – yet fairly – interrogated by someone I felt I'd known for a lifetime from *Spitting Image* cartoons and political legend. His passion for aviation remained undiminished to the end; he could never be fooled.

Perhaps most movingly, Lord Tebbit narrowly survived the IRA bombing at Brighton's Grand Hotel in 1984, emerging from the rubble in his pyjamas with broken ribs and collarbone; his beloved wife Margaret was left permanently disabled. In a deeply private act of devotion, perhaps more telling than any public deed, he stepped back from Cabinet politics shortly after to care for her.

Up to, and after, his retirement from the House of Lords in 2022, he was a vigorous voice in public debate and a dedicated advocate for British aerospace, national security, and industrial self-reliance. Tebbit never sought widespread popularity. But he was – far more crucially for a politician – admired and respected, even by his detractors, for his clarity, determination and bravery.

He later reflected that Michael Foot's infamous "semi-house-trained polecat" insult, intended to wound, had the opposite effect. "It demeaned him," Tebbit wrote, "but gave my career a tremendous lift." Far from derailing him, the jibe propelled him from the backbenches into national political focus. He saw it not just as political theatre, but as a revealing moment of class disdain. "I think he found it outrageous that anyone lacking a university education, especially one from a working-class background, should challenge him at all – let alone challenge him successfully."

For all of us in aviation, he represented a rare breed: a politician who had sat at the controls, understood the machinery, and always remembered the industry that shaped him. He will be remembered not only as a political titan, not only as a fundamentally decent and moral man, but as one of the few to bring the discipline of the cockpit into the heart of government. Norman fought for flight, as he fought for everything else he cared about: fiercely, faithfully, and without compromise.

Robert Courts, KC, FRAeS

Society News

INTERNATIONAL AIR CADET EXCHANGE

On 21 July, the Society hosted a conference as part of International Air Cadet Exchange (IACE) at No.4 Hamilton Place, bringing together cadets and staff from Australia, Belgium, France, Germany, Sweden, the US and the UK.

The event centered around two major themes: 'Sustainability' and the 'Year of the Drone'. These topics reflect the evolving priorities and technological advancements in the aviation and aerospace sectors.

The conference featured a keynote presentation by Poppy Howe ARAeS, Vice Chair of the RAeS Next-Generation Board, which highlighted the critical role of emerging professionals in shaping the future of aviation and the importance of sustainable innovation in aerospace.

The afternoon session saw cadet-led presentations and dynamic discussions on topics, including the challenges and opportunities in driving sustainability and the increasing use of Remotely Piloted and Autonomous Aircraft Systems.

Cadets shared insights and proposed innovative solutions, demonstrating their deep engagement and forward-thinking perspectives. The conference generated meaningful discussions about the future of aerospace and aviation, and the challenges and opportunities facing the next generation of aerospace professionals.

The enthusiasm and ideas shared during the event will, undoubtedly, influence future initiatives and collaborations.

Air Cadets are eligible for free RAeS membership, which is a valuable resource designed to support their development, expand their network, and enhance their career opportunities. They can apply for free at aerosociety.com.

◀ The International Air Cadet Exchange brought together cadets from around the globe.
Sam Leather/RAeS

Sam Leather MRAeS
Community Engagement Officer

Elections

FELLOWS

Meshal AlSaleh
Farrukh Alvi
Kris Belland
Christopher Bigwood
Andrew Blackburn
Andrew Churchill
Fernando Cruz
Andrew Devine
Ross Dunbar
Michael Evans
Mohamed Fawzy
Gerard Forlin KC
Robert French
Angus (Gus) Larard
Garry Lathey
Jing Li
Kristian Mears
Richard Munday
Ryan Oltman
Ali Pourzand
Imran Rafique
Andrew Sibenaler
Vassilios Theofilis

MEMBERS

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Basem Aboudeshish
Emad Aburezq
Hamzah Ahmed
Ali Al Qallaf
Oscar Alonso Ruiz
Mohammed Alosaimi
Iwan Benneyworth
Mukesh Bhasin
Thomas Carter
Pui Yuk Chan
Jack Chen
Henry-Paul Clossick
Glaucia Costa Balvedi
Todd Donaghy
Kenneth Dunlap
Zoe Garstang
Michael Hill
Bruce Hiscox
Kyle Holshausen
Ryan Humphreys
Haydn Jakes
Oliver Jia-Richards
Tharun Jose
Emre Karaselvi
Andrew Kay
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Yue Hong Mak
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Killian McCabe
Andrea Meriano
Siva Muppala
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Daniel Woodward
Zeki Yildirim

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Filip Lalovic
Josef Martin
Steven Owen
Callum Smith
Alexander Thorpe-Morgan
Kieran Wheeler

WITH REGRET

The Royal Aeronautical Society announces, with regret, the death of the following members:

Graham Cropper FRAeS 95
Gary Fury ARAeS 67
Prof Geoffrey Hancock FRAeS 96
David Rosser FRAeS 81
Robert Sherwin-Smith FRAeS 86
Edward Stevens ARAeS 91
Lord Norman Tebbit CRAeS 94

FROM THE ARCHIVE

SEPECAT Jaguar B08, XW566, the first UK two-seater, lands back at Warton at the end of its maiden flight on 30 August 1971. The Jaguar programme saw aircraft built in the UK and France and B08 was the third airframe completed in the UK, following a pair of single-seaters. SEPECAT (*Société Européenne de Production de l'avion Ecole de Combat et d'Appui Tactique* or European Aircraft Production Company Combat and Tactical Support School) was a joint venture between Breguet and the British Aircraft Corporation and one of the first major joint British-French military aircraft programmes. More than 570 Jaguars were built and the type remains in service in India. RAeS/NAL

For daily historic aviation content see the 'On This Day in History' feature on the Society's Facebook and LinkedIn pages.

Did you know?

The Royal Aeronautical Society now has its own WhatsApp channel.

Scan this QR code to keep up to date with happenings, news and events.

Society News

ROYAL OBSERVER CORPS COMMEMORATED

With its origins in the air raids of WW1, and the threat that such raids would pose in any future conflict, the Observer Corps was founded in 1925 as an integral part of the British air defence system. Its initial role was to detect, identify, track and report enemy and allied aircraft across London and the southeast of England.

At the outbreak of WW2, the Corps was mobilised and its cover extended to most of Britain as there then was no radar coverage over land. Its roles were broadened to include air raid warning briefing, guiding home damaged and lost aircraft and calling out air-sea rescue services for downed aircraft. In recognition of its contribution during the Battle of Britain as the 'eyes and ears' of the RAF, King George VI bestowed the title 'Royal' upon the Corps in 1941.

An extensive building programme of operations rooms and reporting posts enabled the Royal Observer Corps (ROC) to be formed into areas and groups, with its headquarters co-located with HQ Fighter Command at RAF Bentley Priory. All 39 ROC operations rooms transmitted information from some 1,600 ROC posts on a 24/7 basis so that RAF controllers could better manage the air battle. Most of these plotting rooms were in telephone exchanges to permit necessary access to extensive telephone lines.

The arrival of the Cold War saw the ROC's tasks further augmented to include the detection and reporting of nuclear explosions, as well as plotting radioactive fallout. A nationwide network of underground bunkers enabled the ROC to operate the UK Warning and Monitoring Organisation (UKWMO), a key element of the country's preparedness for possible nuclear attack. With the ending of the Cold War, the ROC was gradually disbanded and finally stood down in 1995.

One of the ROC's plotting rooms was located in the Grade 1 listed Guildhall in Bury St Edmunds. Inaugurated in 1939, this operated continuously during and after WW2 and, from 1953 to 1968, it was placed on standby training status. It was then repurposed for non-ROC uses and most of the contents were removed. However, following the discovery of its remains, a project was launched in 2013 to restore the centre with volunteers recreating how it would have looked at the height of WW2. It reopened to the public in 2016 as the sole remaining plotting room in the UK.

In 2023, the ROC Association Heritage Team's John Shere made a formal submission to the RAeS under the Aeronautical Awards Scheme to recognise the ROC's crucial contribution to the security of the UK. Following Council's approval, a heritage plaque was unveiled and handed over to the ROC by CEO, David Edwards FRAeS at the Bentley Priory Battle of Britain Museum on 12 July, during the annual Dowding System Day. The plaque will be permanently mounted in the plotting room at Bury St Edmunds.

Gp Capt Mike Hawkins FRAeS

▶ RAeS CEO, David Edwards (left), with Gp Capt Mike Hawkins (centre) and John Shere at Bentley Priory Battle of Britain Museum.
Via Gp Capt Mike Hawkins

FARNBOROUGH MP TOURS THE NAL

Alex Baker, Member of Parliament for Aldershot, Blackwater, Farnborough, Hawley and Yateley East, visited the National Aerospace Library on 28 July, where she enjoyed a guided tour by RAeS CEO, David Edwards, Librarian, Tony Pilmer, and Assistant Archivist, Georgina Townsend. During her visit, she explored a fascinating range of archive material – from early balloon fabric dating back to 1783 to post-war development plans for the Royal Aircraft Establishment, showing particular interest in the Wright brothers' letter collection and Farnborough Airshow programmes.

Georgina Townsend
Assistant Archivist

▶ Alex Baker MP (left) is shown documents from the NAL collection by Assistant Archivist, Georgina Townsend.
Jonathan Clare/RAeS

New Member Spotlight

VALERIO VITI

Name: Valerio Viti

Grade: Fellow

Age: 50

Location: New Hampshire, US

Job title: Senior Manager, Aerospace and Defence team, Synopsis/Ansys

What inspired you into aerospace? It all started from watching some of the Space Shuttle launches on TV during the news as a child, when individual space launches were still news! And what cemented the passion, dare I say it, was watching movies, like *Top Gun*. I believe that the original movie might have grown the cohorts of recruits for pilots, astronauts and aero engineers more than any other single campaign by air forces.

What's the best thing about your current role? Currently, I am managing an extremely talented team of engineers at Synopsys/Ansys that use engineering simulation tools to address technical problems in the aerospace sector that have a significant impact on business outcomes safety, and national security. For example, when we encounter a challenging technical problem with our customers or peers, we always ask ourselves: 'Can I accurately simulate this real-life phenomenon using the current state-of-the-art physics simulation tools?' The simulation needs to be in the service of solving an actual, relevant problem. So, intricately connected with the technology-related question, we also ask ourselves a more business-related question: 'What is the societal or business impact of our solution? Are we improving a design and its performance or are we making a manufacturing process leaner and cheaper? Is the final product more reliable and, ultimately, what is the time or money savings that I am achieving, or what additional capabilities am I adding to my quiver that will set us apart?' Throughout this process, the team's curiosity, creativity and passion for the industry and for the technology we are using are essential to achieve success.

What made you join the RAeS? I was a student member of the RAeS when I was an undergraduate at City University in London, and I loved the networking that the student membership facilitated. I particularly remember a student challenge event hosted by the RAeS at Hamilton Place. The challenge was to design and build a paper glider to safely transport an egg the longest distance using only the provided sheets of paper. The whole day was a blast, and the event was extremely useful in meeting other student members from other universities, and, in the evening, to mingle with the senior members during the reception. So, these fond memories definitely played a role in me joining the RAeS. There is also the visibility and usefulness that RAeS events have in the aerospace community.

What do you hope to get out of your registration with the RAeS? My main focus is to be better connected to what is going on in the UK aerospace sector. Being a member of the RAeS, reading the magazine, receiving the emails with their upcoming events, and participating in as many events as my schedule allows are all great ways to stay informed and build my network.

What three items would you take with you to the space station? I would bring a tablet to watch YouTube (what an incredible source of useful, and less so, information!), a book (probably something from Herman Hesse) and binoculars to look down at the Earth.

Who is your biggest inspiration? My father, for sure, in terms of life guidance and how to carry myself. Professionally, I am fortunate to have an incredibly talented cohort of college and graduate school friends who provide inspiration and guidance. Recently, I was sitting on a panel at a conference in Washington DC, discussing hypersonic technology. Out of the five panellists, four of us were from the same graduate programme and adviser at Virginia Tech, Professor Joseph Schetz. So, I just look around me and it is not difficult to find incredibly inspiring characters.

Piece of advice for someone looking to enter your field? Follow your passion but be realistic. If you have a long-term goal and you are passionate about it, all the hardships that you will encounter and all the hard work you will have to do will make sense, through good and bad weather but also, be realistic. Just because we want something, does not mean we can always get it!

The Last Word

COMMENTARY FROM
Professor Keith Hayward
FRAeS

That which is given can be taken away

Campaigners are calling for the EU Commission to curb 'ancillary charging', specifically the cost of hand luggage, with seven Low-Cost Carriers (LCCs) targeted for action.

The practice of limiting baggage size to fit under the seat in front is almost as old as the LCC model of selling seats cheaply and then making up revenues by charging for almost everything else. The add-on for a mis-sized bag at the gate can be £60. Larger bags can be added at check-in for anything from £6 to in excess of £30 depending on the route. Hold baggage goes for at least £75, so with a large family in tow, this soon makes up for a low-ticket price.

Legal challenges grow

Ryanair is already in court with the Spanish authorities who are demanding it repay one traveller €147 for hand luggage charges. In 2024, Spain fined five airlines £150m for hand luggage and seat reservation charges. Inevitably, Ryanair has taken a robust line countering the attack on ancillary charging, claiming that at least a third of its passengers escape any form of additional boarding costs. Perhaps the Ryanair executives have not had to jump on a lumpy rucksack to make it fit into the metal contraption used to measure the carry-on?!

Ancillary charges now extend to hotel and resort bookings, car hire and insurance. The pressure to cut costs has typically hit the established 'legacy' carriers and it is rare to find a free meal or drink back in steerage class these days. In truth, flying up to two or even three hours without the pleasure of a free G&T is bearable, and better in-flight sandwiches are available even at an over-priced terminal outlet, but the guesswork involved in assessing the size of a carry-on is beyond any sane traveller.

The value of ancillary charges is considerable: in 2013 globally, they were worth $42bn and in 2022 $109bn. This was on average worth 15% of total airline revenues, even more for some LCCs. Even the 'posher' airlines now take in between 5% and 9% of their revenues from charges – a difference between profit and loss.

One can rant on about charging for a family being seated together and all the other irritations of flying LCC but there are limits to what is acceptable practice.

Surge charging, now hitting concert venues, is perhaps not so irritating and a realistic and reasonable means of managing supply and demand; if the increments are reasonable, fair enough.

A more controlled future beckons

The European legal challenge, if that is what it becomes, will be something of an historical irony. From the late 1980s, culminating in the so-called 'Third Package', the EU and its legal processes deregulated the continent's airline market, triggering the import of the LCC business model from the US. This was undoubtedly an all-round victory for the average airline passenger and created much of the basis for today's European and Mediterranean littoral tourist industry.

However, there is the rub; overtourism and other online services pressuring local housing markets are posing a threat to the industry in general, with a backlash demonstrable at several popular destinations. More directly, LCCs along with other carriers, are facing challenges brought by climate change and measures designed to hit carbon neutral targets. Either ticket prices rise or some form of 'rationing' hovers in the background – all in the name of demand management.

> “OVERTOURISM AND OTHER ONLINE SERVICES PRESSURING LOCAL HOUSING MARKETS ARE POSING A THREAT TO THE INDUSTRY IN GENERAL, WITH A BACKLASH DEMONSTRABLE AT SEVERAL POPULAR DESTINATIONS

RAeS HQ, LONDON AND ONLINE
7-8 OCTOBER 2025

ROYAL AERONAUTICAL SOCIETY

RAeS PRESIDENT'S CONFERENCE 2025: PEOPLE IN AEROSPACE

Have you booked your place yet for the **Royal Aeronautical Society's President's Conference 2025: People in Aerospace**, taking place in London and online on 7-8 October?

This important conference puts the spotlight on people's critical roles in future advancements in aerospace. Over the two days, we will discuss current trends, explore strategies and showcase best practices on skills and professional development; the changing workforce; equity, diversity and inclusion (EDI); social responsibility and future leadership.

Join us for insights into these key topics from cross-industry experts from Airbus, Leonardo, Rolls-Royce, RAF, British Airways, Manchester Airports Group (MAG), The Air League, UK Space Agency, Space Skills Alliance, EUROCAE, Cranfield University, City St George's, University of London, STEM Returners, Flight Crowd, EmPower Flight, and more.

The conference will be preceded by our Mental Health Awareness in Aerospace event on 6 October, featuring an afternoon of discussions on this important topic with expert speakers including Professor Robert Bor HonFRAeS – Director of the Centre for Aviation Psychology; Paul Reuter FRAeS – Vice-President of the European Cockpit Association; Lisa Ward – Head of Health and Wellbeing at Heathrow Airport; Maeve Waite – Wellbeing Consultant and Work Psychologist at the CAA and Marc Atherton CPsychol, MRAeS – Registered Aviation Psychologist.

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Join us to be part of these important conversations. Scan the QR code or visit:

www.aerosociety.com/presidents-conf-2025
to find out more and book your place.

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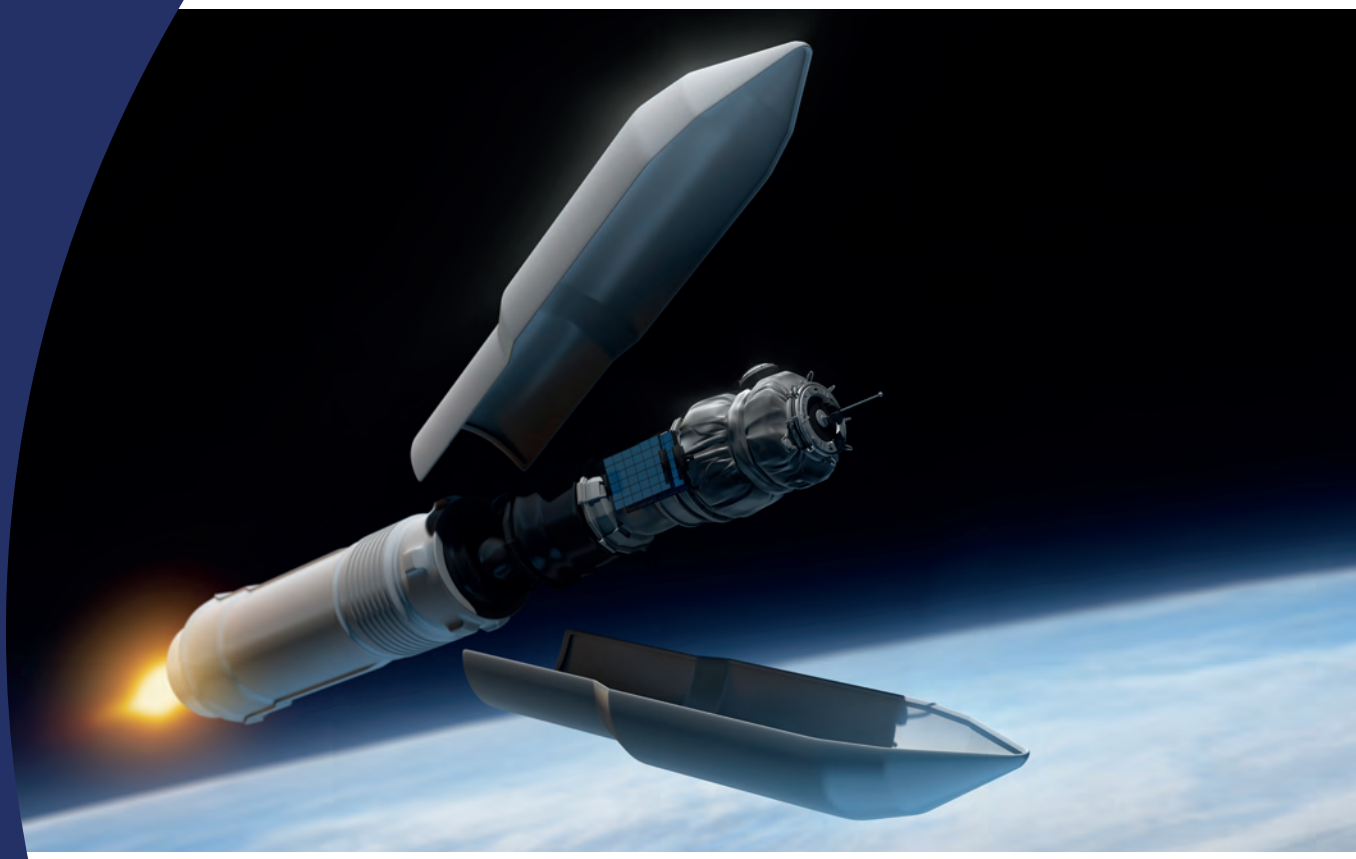

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